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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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The Pennsylvania Railroad on Tuesday made the announcement that, beginning September 1st, 1,000-mile tickets, good over the lines east of Pittsburg and Erie and valid for the transportation of the bearer, will be put on sale. More than this, the maximum one-way fare on all the eastern lines will be reduced to 2½ cents, though on account of the large amount of preparation necessary, this change will have to be postponed until November 1st, or later. This is a notable move in the direction of lower passenger fares, in particular because the Pennsylvania has for some time been the only large system in the part of the country where passenger traffic is densest which has maintained fares at a level practically corresponding with the charges made by many roads in the West. Given the right, under its charter, to maintain a charge of 3 cents a mile for through passengers and 3½ cents for local passengers, the company has, in general, withstood any reduction below those levels. The only mileage book sold has been the interchangeable mileage book good over the Pennsylvania and six other railroads, with its annoying restrictions of a $10 extra payment at the time of purchase and the necessity of signing a mileage slip for each conductor in charge of the train on a journey, in order to safeguard its non-transferable character. These interchangeable mileage tickets, however, are to be continued on sale provided the other railroads interested have no objection. In this way the interchangeable mileage ticket will be left to fulfill what in reality was always its greatest usefulness, that is, making it possible for commercial travelers and others who constantly use a number of different railroads in the same general territory to buy a form of transportation which would at the same time secure a saving in the rate and be good on a number of different roads. For the large numbers of other people who have desired to travel over the Pennsylvania alone enough to use a mileage book, the restrictions thrown about the interchangeable book, which was the only one available, have always been inconvenient and annoying. The decisive character of the Pennsylvania's reduction is perhaps evidenced more by the transferable feature of the new ticket than by the reduction in one-way fares, for unless the railroad is more successful than most other roads in finding a way to prevent the dealing in portions of mileage books, the fact that it will be accepted on presentation by any one will probably result in having a very small proportion of the travel pay over 2 cents a mile. The reduction may seem surprising in view of the figures of the last annual report, which show that on one 800-mile division the passenger business appears to be carried on at an absolute loss. There is, however, scarcely anything more certain than that, except perhaps at the start, the road will not lose by the reduction. As the *Railroad Gazette* has often stated editorially, it is most desirable that fares should be as low and as simple as possible. Such action not only brings about an increase of travel which, in every important case which has been brought to our notice, soon makes up for the lowering of the rate received; but, what is of the largest value to a railroad company, even though not reducible to dollars and cents, is that low and simple fares engender a spirit of confidence and good feeling toward the railroad company on the part of the traveler—which means, pretty generally, on the part of the communities through which the road runs, on whose public opinion the railroad is in the last analysis so entirely dependent.

In connection with the reduction of fares on the Pennsylvania, and in particular as corroborating our opinion that passenger fares should be as low and as simple as possible, the comment of President Mellen, of the New York, New Haven & Hartford on the early results of the reduction of passenger rates on that road, is of interest:

> "The results of our reduction of tariffs to the maximum basis of two cents a mile have, so far as returns are available, proved satisfactory, in that they have increased business sufficiently to make the reduction not a serious loss to us.
>
> "We are hoping by the reduction to largely eliminate the use of the mileage book, which we have always felt was a rank piece of discrimination. We have never understood how it was justifiable that a man with $20 in his pocket should travel cheaper than a man who could only raise $5, and one of our hopes in making the reduction was that we could bring our services more nearly within the reach of all the public and at a common rate, and we are watching this feature of the results with the greatest possible interest.
>
> "We believe our tariffs should be arranged so that every one can travel either five miles or fifty miles at the same rate of fare per mile, and it is our hope that in time the public will appreciate that all classes of transportation should be sold without discrimination in rate, and if such should be the case the general rate could undoubtedly be made even considerably less than two cents a mile to every one without serious loss to the railroad."

THE ILLINOIS CENTRAL CONTROL.

It has been announced that at a meeting of the board of directors of the Illinois Central Railroad held last week, an agreement was reached whereby there will be no contest for control of the road at the annual election in October, between President Stuyvesant Fish on the one hand and Mr. E. H. Harriman, a director of the Illinois Central, and President of the Union Pacific, on the other. As it has never been directly admitted by either of the interested parties that any such contest between them was under way,

they naturally have neither of them verified the announcement of a truce or cessation of hostilities. There have, however, been differences between the two men, and there is little doubt that these have been, at least for the present, laid aside. Besides all other evidences that a settlement has been reached, the laying to rest by the newspapers of a subject which has been so rich in "headliners" is strong circumstantial evidence of the fact.

In 1900 a company organized in 1896 by interests identified with the Illinois Central Railroad began business as the Railroad Securities Company. This company now owns something over $10,000,000 Illinois Central stock. Mr. Harriman is its President and Mr. Fish, its Vice-President. Its board of seven directors includes two Harrimans, the Director of Purchases of the Harriman System, and the successor to a Harriman banker who withdrew at the time the members of the firm of Kuhn, Loeb & Company resigned all their railroad directorships. In a word, the Illinois Central stock held by the Railroad Securities Company is controlled personally by the President of the Union Pacific. Practically, the object of the company has turned out to be to make it possible, by issuing low interest bearing bonds against the stock held, to enable its owners to carry their Illinois Central holdings at small expense. Moreover, this company, in which the two railroad presidents were originally associated on friendly terms, has turned out to be a chief weapon in the hands of Mr. Harriman for opposing Mr. Fish's administration. The developments of the life insurance disclosures of last year are supposed to have widened the breach between the two men, though it is probable that they both have kept their railroad and insurance interests pretty well distinct. There is no doubt, however, that matters were coming more and more to an open rupture between the two ipterests up to the announced settlement of the differences last week.

A glance at the railroad map of the United States west and south of Chicago shows very clearly one reason why the Illinois Central should be desired by the head of the Harriman lines. The Union Pacific controls the dominating route between the Missouri river at Omaha and the Pacific ports of San Francisco and Portland. Its eastern terminus is Omaha. The Southern Pacific has a through route from New Orleans west through the southern tier of states, California and Oregon also to San Francisco and Portland, but has no connection at the east with the Union Pacific. The two roads thus form at present an irregular rectangle including two-thirds of the territory west and south of Chicago, but a rectangle entirely open at its eastern end and with a 500-mile gap on its northeastern corner. The Illinois Central owns a line from Omaha to Chicago and an unexcelled line from Chicago to New Orleans. Thus by its acquisition the Harriman rectangle would at a stroke be completed, the Union Pacific brought into Chicago, and the loose ends of the system brought together by a powerful connection. That in this case it would be the policy of the Union Pacific to abrogate its present existing traffic arrangements at Omaha with the various lines which now connect it with Chicago is not probable, for such action could hardly fail to result in immediately deciding the North-Western, the Burlington, and the Great Western to build or gain other through connections to the Pacific; but, at least, control of the Illinois Central would always make such action potentially possible and would be a great factor of strength by bringing the Harriman lines into Chicago over their own rails. The great value of the Illinois Central, however, would lie in the fact that it is the dominating line from Chicago to the Gulf and controls to a very marked degree the traffic between Chicago and New Orleans. It has the best natural situation. Its entire road between Lake Michigan and the Gulf is already either double tracked or, over alternate routes, has two or more tracks between those points. The Illinois Central's traffic strength and long record of conservatism and successful management have given it, too, a financial credit which would be of great value, particularly to Mr. Harriman, whose principle is to establish a high order of credit for his railroads before attempting to make large returns to his stockholders in dividends.

Another reason why he must desire to exercise control over its policy is because the Illinois Central has made arrangements with other railroads, competitors not of itself but of the Harriman lines, by which these roads secure entrance into New Orleans and a share in the traffic of that constantly growing Gulf port. The particular instance of this which affects the Harriman lines most keenly is the granting of trackage rights by the Illinois Central between Baton Rouge and New Orleans to a road called the Colorado Southern, New Orleans & Pacific, which is controlled by the Rock Island-Frisco interests, and is building a line from Baton Rouge westward through Louisiana and eastern Texas to Houston, parallel to the Southern Pacific's New Orleans-Houston through line. This is to be the eastern connection for another new line paralleling a long-established Harriman property—the Houston & Texas Central. This, the Rock Island-Frisco and Colorado & Southern interests jointly, through the Trinity & Brazos Valley, are building south from Fort Worth into Houston, a line which will bring the Chicago, Rock Island & Pacific, St. Louis & San Francisco, and Colorado & Southern roads into Houston and Galveston, thus at once paralleling the Houston & Texas Central and cutting it off from the interchange traffic received at or near the present southern termini of those roads. On completion of these two new lines the Rock Island Company will control roads into Houston, Galveston and New Orleans, whereas at present, with the exception of the Frisco over New Orleans & Northeastern trackage rights into New Orleans, no Rock Island line reaches the Gulf. Thus the Illinois Central, by granting trackage rights necessary to the success of the new projects, has indirectly had a large share in bringing about the paralleling of two important Harriman lines. As long as it remains independent, there is always a likelihood that by means of similar arrangements other new competition affecting Harriman lines will be made possible. This is by no means Mr. Harriman's idea of territorial control, which in his own peculiar territory has resulted so far in making himself practically supreme, both actually and potentially.

Mr. Harriman's attempts to gain control have been watched with great interest by the large number of Illinois Central stockholders. The Illinois Central is, corporately speaking, an old-fashioned property. The ownership of the company is widely distributed, much of it among holders of small amounts of stock, who hold it as an investment solely. In particular, one great indirect strength of the company has lain in the ownership of many blocks of its stock by residents of the places along its lines. Such ownership has been directly recognized by the company by retaining the now unusual privilege of giving all stockholders a pass over the lines during the week of the annual meeting of the company—a privilege of which advantage is always quite generally taken. As a result, the stockholders' meetings of the road are more largely attended and the managers and stockholders are brought more closely together than on any other large railroad. The management has been thoroughly conservative—too conservative, Mr. Harriman probably thinks. Satisfactory dividends have been paid to the stockholders, and the physical condition of the property has been steadily and largely improved. The characteristic feature is that the interests of the stockholders have been the foremost consideration. The profit, combined with the safety of their investment, has been the one main object. What have come to be the immense resources of the company have not been used to make the road a holding company for an extended system of other lines, although there have been innumerable changes so to do. The result has been no tremendous expansion of mileage and control, but great increases in earnings, gross and net, and in the value of the company's shares which has made them among the most popular of railroad investments. To the holders of stock bought with these characteristics uppermost in mind, the possible advent of a strange control has not been received with enthusiasm. While Mr. Harriman's immense ability as a railroad manager, and his tremendous power throughout the West is clearly recognized, the average stockholder of the Illinois Central has been by no means sure that this ability and power would be devoted to the building up primarily of the Illinois Central; in fact, the probability has seemed to be that the present strength and resources of the most successful north and south line would be used for strengthening the power of the Union Pacific, Mr. Harriman's premier railroad, rather than to the benefit of its own stockholders. It seemed not unlikely that the Illinois Central stockholders would be offered a guarantee by the Union Pacific of six or seven per cent. on their stock, under which arrangement all additional profits from operation of the road would accrue to the Union Pacific itself. Even though such a guarantee would probably raise the market value of Illinois Central shares, the average stockholder would much prefer to have a share in the development of the Illinois Central itself under the quiet and conservative management of President Fish than be assured of the Union Pacific guarantee. The dividend record—or, rather, lack of it—of the Southern Pacific is another factor tending to a preference against Harriman control. This road, on which it is estimated over $150,000,000 has been spent in the past six years, has not as yet made any return whatever to its common stockholders. Although there is no doubt that this policy is resulting in the complete remaking of the road, and will be ultimately of immense advantage to its shareholders, it is hard for the

holder of Southern Pacific common stock to avoid the feeling that he has already contributed far more than his share to the process of reconstruction, and that the devoting of such large sums to the improvement of the road without any return to himself, savors of management for interests other than those of the stockholders at large. In a word, the typical Illinois Central stockholder would rather have the road remain under the present management and as an independent system, even with the possibility of immediate smaller returns to himself, than to have it fall into hands which would make it only a part of a much larger and much more spectacular group.

At any rate, it seems probable that for a year at least, and probably longer, the present executive of the Illinois Central will remain in power. That this means, however, the final abandonment of an effort on the part of the Harriman interests to gain control of the road is by no means certain. It can never fail to be a tempting acquisition as long as the Union Pacific terminates at Omaha and the Southern Pacific at New Orleans. It is probable that the further efforts made for its acquisition will depend on developments during the next few years in the territory between Chicago and Omaha on the north and New Orleans and Galveston on the south, particularly in regard to the success of the Rock Island's new lines paralleling Harriman properties. It is, however, reasonably certain that any attempt on Mr. Harriman's part to secure control will always be opposed by a large body of small stockholders whose proxies may perhaps not be sufficient in themselves to hold the balance of power, but whose moral support is of no small value to a management. This moral support will long be at the command of President Fish.

THE HEPBURN LAW—A BREIF REVIEW.

Whether the Hepburn railroad rate law will work for good or evil on the transportation and commercial interests of the United States is a question to which a complete and definite answer cannot be made with confidence at this time, but on the whole there does not seem to be serious ground for belief that its operation will be harmful if it is administered with intelligence and if it is construed by the courts in accordance with the general understanding as to the intentions of Congress.

One thing which is certainly not to be regretted is that the enactment of this law ought to keep the railroad question out of national politics for some years to come, permitting the roads to devote their energies to the development of their lines and the improvement of their service, with reasonable assurance that revolutionary and destructive national legislation is not to be feared. The very unanimity of its enactment ought to insure its permanency. The Republicans are committed to it because they were in complete control of Congress, and Democrats cannot attack it because it had practically unanimous Democratic support.

The law as passed is a complete compliance with the recommendations of President Roosevelt, going even farther than he advised on some points. On the other hand, it does not go as far as was advocated by the extremists, in that it does not permit the fixing of absolute or minimum rates by the Interstate Commerce Commission, and in that it keeps the doors of the courts open for the review of orders issued by the Commission, and does not make the commerce of the country the football of partisan politics by giving a political commission unrestricted and autocratic power over the rates at which it shall be carried.

When carefully analyzed, it will be found that the new law makes surprisingly few fundamental changes in the act of 1887, as supplemented by the Elkins act, and that, in the main, it is confined to legislation intended to facilitate the carrying out of the intention of Congress in framing the original act. It lays down no new rule for determining the legality of a rate, and any rate that was lawful under the old law is now a lawful rate under the new law. Congress has simply endeavored to make more speedy and certain the correction of a rate found to be unlawful, either considered by itself or with relation to other rates, within the limitations that the act of 1887 dealt with the relation of rates.

It has been popularly believed that the Interstate Commerce Commission was powerless to compel the reduction of a rate found to be unreasonably high, but this is not true. The old law gave to the Commission full authority to condemn an unreasonable rate and to order its reduction, but not to fix the amount of the reduction. It has been objected that this left the door open to the possibility of mere technical compliance with the law, and that it would require an indefinite number of successive orders to bring about a substantial reduction. In the entire history of the law, however, there has not been a single case of such trifling with the Commission, and the power has existed in the courts to compel a specific reduction. The only change now made is that of empowering the Commission to fix the exact reduction to be made by prescribing a maximum rate to replace that condemned. The Commission is also empowered to prescribe changes in regulations and practices affecting rates when such regulations or practices are found to be unjust or unreasonable or otherwise unlawful. This provision of the law goes as far as it is possible to go if the Commission is not to be given power to prescribe absolute or both maximum and minimum rates, and thus to determine the relative advantages to be enjoyed by competing communities.

A most important change in the law is the provision that orders of the Commission shall take effect at such time, not exceeding thirty days, and shall remain in effect for such period, not exceeding two years, as shall be prescribed by the Commission. This provision will have the effect of giving a lawful order of the Commission the force of a statute, and the burden of proof will rest on the carrier attacking its lawfulness. Heretofore the burden of proof has rested on the Commission to establish the lawfulness of any order not complied with by a carrier. This change and the provision of heavy penalties for disregarding an order—the penalties running from the date fixed for it to become effective—made it necessary for the protection of the carriers that the courts should be allowed to exercise their usual power of granting preliminary injunctions suspending the operation of an order pending its judicial review. The provision that such injunction may be granted only on hearing after not less than five days' notice is not a restriction on the ultimate right of the court to grant a preliminary injunction and is not unreasonable, as it is not to be supposed that the Commission will fix the date for the taking effect of the order so as not to allow time for the notice and hearing.

The Hepburn law makes no change in principle in the provision for the filing and posting of schedules of charges. It was the intention of the original law to require such filing and posting so as to place all shippers similarly situated on an absolutely equal footing.

The new law undertakes to insure this more certainly by requiring the roads to state separately all charges of every kind and everything in any way affecting the value of the service. This is expected to be of special value in checking any tendency to undue allowances to terminal roads, elevators, private cars, etc. Carriers participating in through rates, other than the carrier filing the schedule, are only required to file such evidence of their concurrence as the Commission may require, and the provision for the filing of "the separately established rates, fares and charges applied to through transportation" where no joint rate has been established authorizes the filing of "proportional tariffs" giving rates to be applied locally on traffic originating or destined beyond the points between which the tariff applies.

The new law attempts to confer on the Interstate Commerce Commission authority to establish through routes, to fix maximum joint rates and to prescribe the terms and conditions under which such through routes shall be operated, but this power can only be exercised when the carriers have failed to establish such routes and when no reasonable or satisfactory through rate exists. The language, "this provision shall apply when one of the connecting carriers is a water line," was evidently intended by Congress to mean that it should apply in such cases as well as when all were rail lines, but it has been suggested that a strict construction would make it apply only when one was a water line. This entire provision is one of very doubtful constitutionality, and whether it will be effective or not will depend upon the decision of the courts on the constitutional question.

The wisdom of the extension of the time required for notice of any intended increase or decrease in rates to thirty days, subject to the power of the Commission to suspend the requirement of notice altogether or to allow changes on shorter notice, will depend upon the wisdom with which the Commission exercises the discretion conferred upon it. The object of Congress was to prevent the issuance of "midnight tariffs," but a rigid adherence by the Commission to a requirement of thirty days' notice would be disastrous and would doubtless tend to petrify all rates to a greater or less extent and to prevent reductions that would otherwise be made. The course of wisdom on the part of the Commission will be to insist upon the thirty days when there is reason to suspect that a change on shorter notice would result in discrimination, and to allow the utmost liberty as to reductions and advances in other cases. There is little doubt that the Commission will exercise its authority to suspend the requirement for the publication of rates altogether on export traffic, where it can be shown that such publi-

cation would tend to give an advantage to foreign competitors or to subject American exporters to hardships.

A provision of the new law, the constitutionality of which will probably be tested, is that relating to through bills of lading, which seeks to make the initial carrier of goods shipped over a through route the absolute insurer of the goods from loss or damage resulting from any cause whatsoever except an act of God or the public enemy. No contract or agreement waiving this liability is to be valid, and the initial carrier is given the right to recover from the carrier on whose line the loss or damage occurred. This provision was inserted in the law at the instance of bankers who seek to have bills of lading made negotiable papers, as good for collateral as a government bond when issued by a solvent road. Practically it presents several difficulties. One that will occur at once to any traffic man is the impossibility of determining in many instances on which one of several lines the loss or damage complained of occurred, and in such cases it would seem that the initial carrier alone could be held responsible. Another difficulty is that it must have a decided tendency to keep up and even to advance freight charges on articles liable to damage in transit. If the initial carrier is to act as an underwriter it must regard part of its charge as an insurance premium, and the shipper must insure his goods and pay the premium whether he wishes to do so or not. It will also compel the roads to take steps to assure themselves that the goods shipped are of the character and value stated by the shipper, and, in many cases, the roads will be compelled, in self-protection, to require the adoption of certain prescribed methods of packing, and this will be another item of additional expense to shippers. On the whole, this provision of the law does not promise to give much satisfaction either to the carrier or to the shipper.

A provision of great importance to many roads, if it is found to be constitutional, is that which forbids a railroad company on and after May 1, 1908, to transport, except for its own use in its business as a common carrier, any commodity, except timber and its manufactured products, that has been produced by the railroad company or under its authority, or that is owned wholly or in part by it. The intent of this provision is to prevent discrimination by a road in favor of its own shipments. Had it become effective at once it would doubtless have demoralized some lines of business—notably that of producing and marketing anthracite—but the time allowed will probably enable adjustments to be made that will obviate serious confusion in business. It seems probable that this provision, if it is sustained by the courts, will tend to retard development in some sections where it will be difficult to secure the simultaneous construction of railroads and launching of industries unless both can be under a common management.

The new law gives to the Commission very broad discretionary powers to control the character of statistical reports made by carriers, and to prescribe the forms of any and all accounts, records and memoranda to be kept by them, and requires all such accounts, records and memoranda to be kept open to inspection at all times. The purpose of Congress in this was to facilitate securing evidence of rebates and discriminations. There can be no reasonable objection to this if the discretion given the Commission shall be wisely exercised, but if it is exercised unwisely it may impose on the roads great embarrassment and much unnecessary expense.

Not least important are the amendments to the Elkins act made by the new law. Preserving the provision making the published rate the lawful rate, and subjecting the road departing from it, and the shipper soliciting or accepting a rebate, concession or discrimination to a fine of not less than $1,000 nor more than $20,000, the Hepburn law restores the penalty of imprisonment and extends it so as to cover the person or the representative of a corporation soliciting or receiving a rebate or discrimination, as well as the officer or agent of the carrier granting it. Another provision that ought to be very effective in putting a stop to attempts to extort rebates and discriminatory favors from carriers is that making the receivers liable to a fine of three times the value of the favor received. As the railroads have declared that they would favor any legislation that would tend to lessen the evil of rebating in its various forms, this feature of the law ought to be satisfactory to carriers and public alike.

Against the anti-pass provision of the new law no reasonable objection can be urged. It will cut off passes from most of those not fairly entitled to free transportation, while they will still be available for officers and employees and others properly entitled to them.

The new law brings within its scope pipe lines used for the interstate transportation of oil, express companies and sleeping car companies, and extends the provisions of the original interstate commerce law and of the Elkins law over them, the only exception being the limitation to railroads of the provision prohibiting a road from transporting any commodity produced or owned by it or in which it may have a direct or indirect interest when not intended for its own use.

Municipal ownership of street railroads has within the last year made great progress in New York City, if one were to judge by the speeches of certain politicians and the utterances of Mr. Hearst's newspaper; but on July 25 the agitators of this question in Brooklyn Borough were suddenly awakened by a call to consider acts instead of words—that is to say, the act of the directors of the Brooklyn Rapid Transit Company, who on the day before had decided to abandon all plans for the extension of their lines into the undeveloped parts of the borough. This decision was due to the policy of obstruction persistently followed by city officials, mainly Mr. Coler, president of the borough. Mr. E. W. Winter, president of the company, speaking regarding the radical position taken by the directors, which will greatly affect the real estate market in many districts, said:

"While at the same time endeavoring to get rights for considerable new construction, the energies of the company, during the three years last past have been chiefly devoted to the work of putting the existing property into first-class condition by reconstruction and procurement of certain essentials to efficient operation, such as cars, power houses, sub-stations, shops, etc., which it was seriously lacking.

"The next general move of importance would naturally be the development of new territory. It has been the expectation and desire of the company to take this up with the present season and push the construction of lines with as much energy as has been given to the other work referred to. How this movement has been defeated and the supplying of transportation facilities to outlying districts made still more remote by the interposition of one obstruction after another, is a matter of public knowledge.

"The Brooklyn Rapid Transit Company is beyond danger of financial reverses arising out of a killing policy manifested through the refusal to grant privileges or the imposition of such terms and conditions as necessarily preclude their acceptance. It already has enough lines through sections rapidly developing, but as yet enjoying relatively light traffic, to add largely as time passes to its gross and net earnings, and it will devote itself to building up and caring for the business of the system as it now stands. The policy of the company in pushing work of internal improvements will continue."

Mr. Coler was elected last autumn by voters who wished to "get even" with the Brooklyn Rapid Transit Company. These voters now reap the result of electing a man whose plan of procedure is so indefinite, or impracticable, or devoid of respectable and intelligent support that his only resource is obstruction. Mr. Winter has concluded, evidently, to meet the "M. O." party with its own weapon—obstruction.

The Interstate Commerce Commission evidently intends to take the occasion of the passage of the amendments to the law concerning the filing and posting of tariffs, not only to properly enforce the new provisions but to reform those features of the practice in this matter which are not affected by the change—and which have long needed improvement. To this end the commission on July 25 issued what amounted to an invitation to the railroads to join in a conference concerning what ought to be done. The invitation, after quoting those amendments to Section 6 which have been adopted this year and which take effect August 28, goes on as follows:

It is manifest that existing schedules must be changed or amended to bring them into full compliance with the provisions of law above set forth. These changes or amendments can be made most satisfactorily, and at the same time with greater uniformity, through the prompt action and co-operation of all carriers subject to the law, and to that end such carriers, through special committees or their representatives in traffic associations, are requested to immediately confer and thereupon propose to the Commission such methods of procedure respecting the changes necessary to be made in tariff construction, including the simplification of present rules and regulations and of exceptions to the application of specified rates, the definite statement of joint routes upon which through rates are to apply, and appropriate means of certainly indicating evidence of concurrence in joint through rates both to the Commission and to the public, while at the same time providing for plainly showing upon suitable schedules the services and the various charges required by the law to be published and filed.

The Commission is of the opinion that this duty should rest primarily with the carriers themselves, in view of their liability to forfeiture and penalties in cases of failure to comply with the mandatory requirements of the sixth section. The Commission will, however, cordially co-operate with representatives of the carriers, and will freely discuss with them all pertinent questions which in this connection may arise, reserving always its right to make at such times as may appear necessary any general or special order or orders within the scope of its authority. Methods so proposed by carriers should embrace those designed to effectuate immediate substantial compliance with the amended law as well as those intended to be permanently applicable.

Several conferences have been held at Washington this week, representatives being present from both western and southern railroads. One of the railroad men present gave the following outline of the requests which they will present to the commission:

First. That a reasonable extension of time be given them to prepare and publish and file with the Commission their new tariff schedule under the law, and that the book containing the rates might be left with each station agent, instead of being posted at the station.

Second. That the requirement of a notice of thirty days in a change of a

rate or rates be eliminated, particularly as to import and export traffic.

Third. That the railroads be relieved from the publication of terminal rates at points of destination and allowed to publish them only at the point where the charges originate. This would make no difference in the rates themselves, and it would be a matter of convenience to the roads.

With tariffs in use everywhere which fill a book of three or four hundred pages, it is plain that the last part of the first request ought to be granted, in some way or other. The "posted" books in the waiting rooms of country stations have been one of the unpleasant disfigurements of such rooms for the last 19 years. The difficulty about announcing export freight rates, which have always been changed with nearly every change in the tides, remains as troublesome as ever. It is to be hoped that the commission will devise some way to put the railroads on their good behavior. With fair and open treatment of all shippers the question of publication becomes of minor importance. Without fair treatment of shippers by the railroads at all times the commission may well assume that the public will approve the most drastic enforcement of the letter of the law. The third request refers, we suppose, to switching charges, demurrage, elevator charges, etc. Concerning these there is ample room for modifying the letter of the statute, to the relief of the railroads and the convenience of the shippers. There will be comparatively little trouble in publishing these items when everybody becomes willing to publish them.

The chief of the Japanese Railroad Commission, Ichyj Yamanougi, reports to Kanetake Oura, the Minister of Transportation, that at the end of the fiscal year 1904-05 there were 5,599½ miles of railroad in Japan, of which 2,080 miles were state railroads, while the other 3,519 miles belonged to 39 different companies. Of this mileage, however, 906 miles were not yet in operation. The average cost per mile had been $41,912. The rolling stock consisted of 1,644 locomotives, 5,242 passenger cars and 24,408 freight cars. The statistics of operation show that the train service was equivalent on the average to just 10 trains each way daily over the whole mileage, with an average of 15 cars per train. The traffic amounted to 631 passengers and 349 tons of freight each way daily. (In the United States the corresponding average density of traffic was 143 passengers and 1,136 tons of freight each way daily.) The average trainload in Japan was 63 passengers and 34½ tons of freight. Passenger and freight train mileage are not given separately in the abstract before us; and a very large part of the trains carry both passengers and freight. The figures, however, show that the passenger trains are much better filled than here, where the average passenger train load was (1903-04) 46 persons; but the average freight train load 308 tons. The average length of journey in Japan was 20⅝ miles; the average haul of freight, 61½ miles. More than 95 per cent. of the passengers traveled third class, 4½ per cent. second class, and only five-sixteenths of 1 per cent. first class.

The earnings from passengers averaged 0.69 cent per mile; the earnings per ton of freight, 1.03 cents per mile. At these rates the gross earnings of the Japanese railroads averaged $6,279 per mile; 45 per cent. of this was absorbed by the working expenses, leaving $3,440 per mile of net earnings, which compares very favorably with the $2,998 of net earnings per mile in this country in the previous year.

A recent newspaper statement, to the effect that the Pennsylvania Railroad has abandoned the plan of paying freight house men for their work by the tons handled, appears to have been the product solely of someone's imagination. At any rate, the agent at a prominent station not far from Pittsburg informs us not only that the plan is still in full force at his station but that the men are eminently satisfied with it. The agent believes that they could not be induced by any reasonable hour-rate to give up the piece work plan. Moreover, the plan is highly satisfactory from the standpoint of the employer, as the same work can be done more promptly than when done by the old plan, and with a reduction of 25 per cent. or more in the number of men.

NEW PUBLICATIONS.

Record of Recent Construction—No. 56. Baldwin Locomotive Works, Philadelphia, Pa.; 30 pages; 6x9 in., 18 engravings.

This last issue of the series of Recent Construction gives a brief and exceedingly interesting sketch of the development and growth of the motive power upon the Atchison, Topeka & Santa Fe, and although the story relates to this one road the general outline of the progress made in design and the increase of weights, holds for every road in the country. Starting in 1875, the first engines were eight-wheelers (4-4-0), with 16-in. by 24-in. cylinders, and a total weight of 67,000 lbs. Three years later engines of the same type were given 17 in. by 24 in. cylinders and a weight of 73,000 lbs. At the same time an exceedingly large consolidation locomotive, for the time, was built for a branch line, with cylinders 20 in. by 26 in., carrying a steam pressure of 130 lbs. and weighing 115,000 lbs. In this way the capacity and weight of the engines were increased until in 1902 a tandem decapod (2-10-0) was brought out, having 19 in. and 32 in. by 32 in. cylinders and a weight of 267,800 lbs., with a steam pressure of 225 lbs. These are figures of growth with which all railroad men are familiar, and like most familiar things it is interesting to have them presented in such convenient and readable form.

CONTRIBUTIONS

Hollow Staybolts.

Cuyahoga Falls, Ohio, July 26, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the report on flexible staybolts, read at the Master Mechanics' Convention at Atlantic City, there were a few references to hollow staybolts which merit attention. This report covered a single type of bolt; evidence had been sought on that type alone, and any reference to other types on which evidence had not been obtained was certainly irrelevant, unfair and uncalled for.

This report was not written, and I think not read, by the good men whose names are joined to it, and as any erroneous or malicious statement is against the public interest, permit me in justice to the makers of hollow staybolts and to the railroads of this country, to call attention to some of the statements of the writer of the report, a recent graduate of Cornell, and compare them with the cold facts of actual experience and the record of actual service.

He says: "As the use of the telltale hole is a disputed practice, its action not being accepted as positive, and as it adds to the expense of application and maintenance, it is not to be recommended." I agree with the writer in that statement only, and let me say that while waiting for a train at Sunbury, Pa., I went into the shops there and was shown about a dozen bolts which had been taken out of an engine a few days before; they were broken, and steam had failed to indicate failure, because the telltale holes were filled, in part, with dirt so hard that it felt like metal when I tried the holes. I have seen many other cases like this in different parts of the country, but I have never seen a hollow staybolt which was closed by dirt or sediment.

He speaks of the claims made for hollow staybolts, viz.: better combustion and absolute indication of failure of the stay, and casts them aside with the remark that these claims are "not proven." Our young friend certainly shows hardihood, and thrusts his "not proven" against *prima facie* facts in science and the cold stern facts of actual service, not service of a few years, but the service of from 10 to 25 years.

Quite recently the firebox of a switching engine on the Lake Shore & Michigan Southern was removed. It was built in Schenectady in 1892. Mr. Fred Lippert, a fellow student of Cornell, with the writer of the report, examined the hollow bolts with which it was stayed, and "found the holes in all the bolts free from sediment, scale or dirt"—14 years' proof that the hollow bolts were absolutely reliable detectors. This engine carried 150 lbs. pressure.

Every student of combustion knows that it is desirable to admit air in well distributed quantities among the gases. When we do this the gas is burned, when we do not do so the gas becomes black smoke and the heat is lost.

Before the hollow staybolts were perfected for use, about 18 years ago, there had been installations of hollow material for the purpose of bettering combustion. I have seen within a year some of the old engines that received those installations to better combustion. Their service is indicated in the following table:

Southern Railway.—Engine 1884, built in 1881 with hollow staybolts on each side of the firebox.

Boston & Maine.—Two engines in 1883, one in 1888 with hollow staybolts on each side of the firebox.

Pittsburg, Shawmut & Northern.—Four engines built in 1890, stayed with Falls hollow staybolt iron and in service ever since.

Long Island Railroad.—Ten engines stayed, over ten years ago with hollow staybolt iron, in service since, without change until 1905, when a new firebox was installed.

Texas & Pacific.—Has been saving money in bettered combustion by air through hollow staybolts for over ten years.

International & Great Northern.—Has been saving money in bettered combustion by air through hollow staybolts since 1892.

The Canadian Pacific, and other railroads, east, west, north and south, and in foreign countries, have had experiences which refute the "not proven" of the writer of the report.

And now, as all other bolts are solid and he does not approve of the telltale hole (nor do I)—where, except in the hollow staybolt, can he get a bolt of any description that will "absolutely indicate failure," and what bolt, save the hollow staybolt, can be utilized to better combustion?

The man who tears down a useful article should have something better to take its place; if not, he is an enemy to progress. But the writer of that report has found nothing better to take the place of the hollow staybolt. A careful reading of his own report

will show that as an alternative deduction, and his own evidence, proves his conclusions inconsistent and erroneous.

I saw in the testing room of one of the large railroads in the South, samples of broken solid staybolts, which had been coated with impurities from the water, preventing the conduction of the heat from the bolt to the water. The ends of the bolts when coated had commenced to burn, and the burning had continued along the line of the fibers until the steam pressure between the inner and outer sheets pressed the inner sheet out over the bolt heads. The bolts for about half their length were reduced in diameter, the threads were gone, and the diameter was smallest just inside the inner sheet; a part of the coating had dropped off the other half of the bolt, allowing the water to get to it, and that half of the bolt with its threads was uninjured. Those were dangerous conditions, which could not have occurred if the hollow staybolt had been in use, owing to the passage of air through them.

The outlay by railroads for weekly or monthly tests with a hammer to discover by sound the broken staybolts is large—and an uncertain, costly way to discover breakages. Telltale holes add more to the cost of examination. The drilling of telltale holes in the ends is a disputed good, and, in my opinion, it is a substantial evil, whereas there is a warning at either end of every hollow staybolt in the firebox to report breakages when breakages occur, without the touch of a hammer or the cost of a cent, and without risk of a lawsuit, such as related as follows:

"We had an explosion."

"What," I said, "was the cause?"

"Oh, the witnesses swore the examination was imperfect."

"What examination?"

"An examination of the staybolts."

"Was the explosion caused by a broken staybolt?"

"Yes."

"And what was the result of the suit?"

"Oh, there was a verdict against us for $10,000."

"And what was the brand of the iron in the staybolts?"

"It was the —— iron."

"What an awful price," I said, "to pay for —— iron."

In contrast to that experience, I was in conversation at the convention with a Superintendent of Motive Power, having 350 to 400 locomotives, a constant user of hollow staybolts for over 10 years. He said he had no anxieties about breaking staybolts, for when they broke they made the breakage known. No examinations were necessary, for the holes are always open, and he said he was able to keep 97 per cent. of his engines in service. His savings in respect to examinations alone amounted to $25 to $35 a day.

That man had no fear of having to pay $10,000 for damages by reason of explosions. He had no grief to trouble his thoughts about a widow and fatherless children with their breadwinner sacrificed to "imperfect examinations." He did not depend on fallible man, he depended on the hole through the center of the bolt.

JOHN LIVINGSTONE.

Brown's Discipline on the Rock Island.

The Chicago, Rock Island & Pacific Railroad has adopted discipline by record, taking the place of discipline by suspension, effective July 15. The new rule applies to all transportation service employees, and all will be considered as starting with a clear record as far as the new form of discipline is concerned. As heretofore, employees will be subject to immediate dismissal for disloyalty, dishonesty, desertion, intemperance, insubordination, wilful neglect, immorality, violation of rules whereby property belonging to the company is endangered or destroyed, making false reports, or concealing facts under investigation. Credits will be entered on employees' records for notably excellent conduct, deeds of heroism, conspicuous loyalty and marked ability, or good judgment in handling emergencies.

The following rules will govern debits and credits:

Each person receiving 65 demerits will be dismissed from the service of the company [but not until after the case is reviewed by the General Superintendent].

No suspension will be made for less than five days nor for more than 30.

Reprimands and suspensions on the records of employees may be canceled as follows:

Reprimands will be canceled by three months' perfect record.

A suspension of 10 days will be canceled by four months' perfect record.

Eight months' perfect record will cancel a 20 days' suspension, and one year's perfect record will cancel a 30 days' suspension.

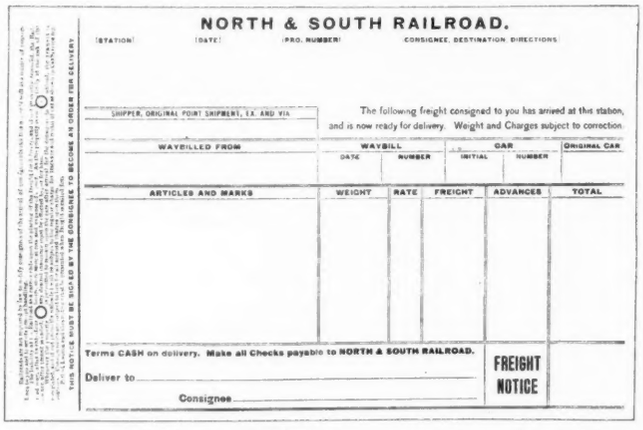
Credits for perfect records will not be entered unless debit marks exist on the record of the employee.

Credits for extraordinary records will be given at all times, regardless of the record of the employee, and such credits accumulated in advance will lessen the punishment in case an offense is committed.

Hutchins' Freight Arrival Record Forms.[1]

Mr. F. Lincoln Hutchins, of the Boston & Maine, after careful experiments with different forms, has devised a set of five blanks for dealing with "freight received," all to be filled at one writing (with carbon sheets), which has proved more economical and satisfactory than anything of the kind that we recall, and the blanks, which have been in use at Warren Bridge Station, Boston, since November last, are to be used throughout the Boston & Maine system. Mr. Hutchins describes the scheme as follows:

All papers necessary for the handling of freight and collecting the revenue thereon should be made at the originating point at the


NORTH & SOUTH RAILROAD.

(STATION) (DATE) (PRO. NUMBER) CONSIGNEE, DESTINATION, DIRECTIONS

SHIPPER, ORIGINAL POINT SHIPMENT, EX. AND VIA

The following freight consigned to you has arrived at this station, and is now ready for delivery. Weight and Charges subject to correction.

WAYBILLED FROM | WAYBILL DATE | WAYBILL NUMBER | CAR INITIAL | CAR NUMBER | ORIGINAL CAR

ARTICLES AND MARKS | WEIGHT | RATE | FREIGHT | ADVANCES | TOTAL

Terms CASH on delivery. Make all Checks payable to NORTH & SOUTH RAILROAD.

Deliver to

Consignee

FREIGHT NOTICE

same time and with the way-bill, but until the railroads are ready to adopt this most logical and economical method, improvements are in order on the existing methods.

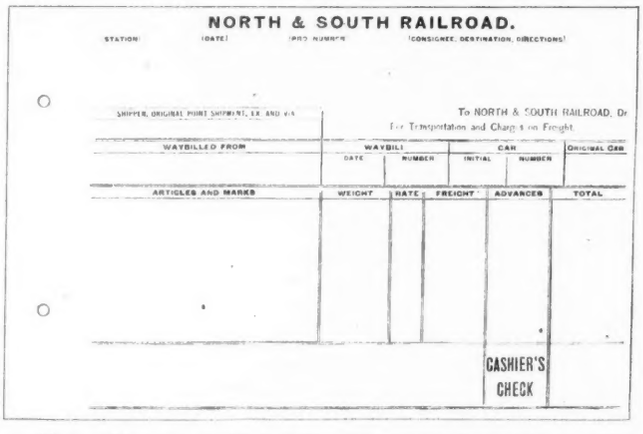
The forms shown herewith embody an attempt to improve on the usual methods at the destination station. They comprise the following:

1. The freight arrival notice.
2. The cashier's memorandum check.
3. The freight bill.
4. The delivery receipt.
5. The check out slip.

They are to be of different colors, so as to be readily distinguished, and may be blocked in the usual manner with fifty sets in a block, or each set separately held together by glue; or they may be wire stitched. The forms are to be 8½ in. long by 5½ in. wide,* printed to register accurately and punched at the left margin for filing. Those parts of the wording which it is most necessary to have conveniently located, the name of the consignee, for example, are put far enough to the right to avoid being interfered with by the binding at the left. The number, important in sorting and filing, is kept far from the corner, so as not to be in danger of being torn off.

All the forms being filled in with one operation upon a typewriter there is absolute identity and perfect legibility with all five.

The arrival notice is ready for immediate distribution without duplication of work. It will be found to be more economical than the postal card form.


NORTH & SOUTH RAILROAD.

(STATION) (DATE) (PRO. NUMBER) (CONSIGNEE, DESTINATION, DIRECTIONS)

SHIPPER, ORIGINAL POINT SHIPMENT, EX. AND VIA

To NORTH & SOUTH RAILROAD, Dr.
For Transportation and Charges on Freight

WAYBILLED FROM | WAYBILL DATE | WAYBILL NUMBER | CAR INITIAL | CAR NUMBER | ORIGINAL CAR

ARTICLES AND MARKS | WEIGHT | RATE | FREIGHT | ADVANCES | TOTAL

CASHIER'S CHECK

The cashier is provided with papers most favorable to quick handling. He is safeguarded against illegibility or change of figures.

A plain and easily handled sheet is provided by which to tally consignments out of the car.

The cost of making and handling the several papers is reduced materially.

[1] Copyright, 1906, by F. Lincoln Hutchins.

*The facsimiles shown here are reduced a little more than one-half.

The arrangement of the spaces to be filled is such that the movements of the machine are minimized. It will be noticed that the name of the station (which in the case of large stations may be printed in), the date, the progressive number, and the name of the consignee, occupy but one line. The billing reference and car numbers occupy another line, only one inch below, so that but two movements of the feed roll are required from the insertion down to the space for articles and charges. For instance, take a shipment from New York City to Albany, N. Y., for Knickerbocker & Co. On the first line we have:

Albany, April 10, 1906. 12,765 Knickerbocker & Co.

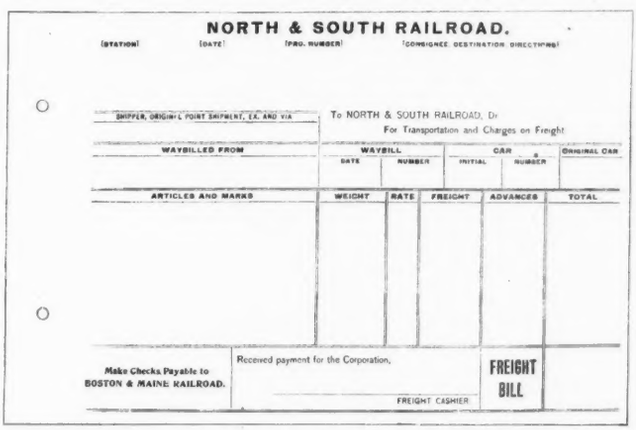
and upon the line below:

New York City, April 9. 86 N. Y. C., 12,767.

It is only the exceptional voucher that requires the shipper's name, original point of shipment, Ex., or via; and only in cases of freight "to order," or to points beyond, that destination and directions are necessary. In such cases there is ample room on the blank for the desired information.

The five forms, having been filled in simultaneously by using interleaved carbon sheets, are easily handled. The arrival notice and check-out slips having been detached, the rest of the papers go to the cashier without delay. The check-out slips, alphabetically arranged and placed in holders, go immediately to the checkman, while the arrival notices, checked with the train or location lists, to assure arrival and placing, are distributed by mail or messenger.

The check-out slip serves several useful ends. Being made at the same time as the freight bill it should be ready to use before the outturn of the car could be in demand; it saves the time and work of copying the waybills on tally sheets with the chance of errors, and it is a more legible record in more convenient form for the checkman's use, and as it is identical with the delivery receipt, it promotes correct delivery. After serving all purposes of checking out of the freight and making exception papers, it may be



bound up in progressive number order and become the freight received record book, without further duplicating of the work. It has the advantage of identity with the freight bill, the notice and the receipt, and bears the full checking record.

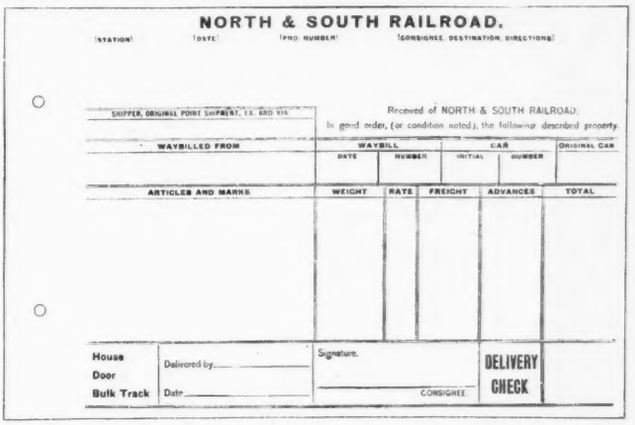
This method makes it possible to do away with the expensive and unsatisfactory "blind check." Theoretically, the blind check is the only method of securing a correct record of goods received, but its unreliability is such as to make it unsafe to issue exception reports upon it, and it is the universal custom, when the billing and the checking do not agree, to recheck the freight, a troublesome and expensive process, which generally results in proving the billing right and the checking wrong. It often happens that the freight cannot be rechecked. Then, for safety, the report is issued, but only to have it proved to be in error. The work is worse than useless, as it impairs confidence in future reports. The blind check is troublesome at transfer points, because it is absolutely necessary to know the routing and other particulars carried by the billing in order to handle the freight with despatch.

It is not always possible to allow the checker the use of the original waybill, and even where this can be done the bills are not so easily handled, nor is the checking record so easily made and kept, as with the uniform sized check-out slip, for the checkman, taking the convenient holder, with its alphabetically arranged slips, has a compact, handy and serviceable means for the correct and expeditious checking of his freight. He will check each item, note all discrepancies and any unusual condition upon the face of the slip and send it to the office, where the required exception reports will be made. The slips will be accumulated on temporary files until ready to be arranged in order and bound as the freight received record. This not only saves the waste of rewriting all the received business, but makes that record include the checking facts.

At points handling both local and transfer business it may be best to make single check-out slips for the through billing in order to have uniform papers for the checker's use and to secure a permanent record of the checking of the passing business.

While the forms are preferably filled in by typewriter, they are adaptable to the pencil. Pencils can be used whenever the business does not warrant the use of a typewriter, or where the rush of business exhausts the capacity of the machines in use.

The typewriter used should be of the kind known as visible writers so that no time be lost in moving to the exact spaces to be filled. It should have the improved form of figures so that even a light impression would produce figures that could not be mistaken for others, as may happen in the use of the ordinary characters, and it should be mechanically constructed to stand the hard

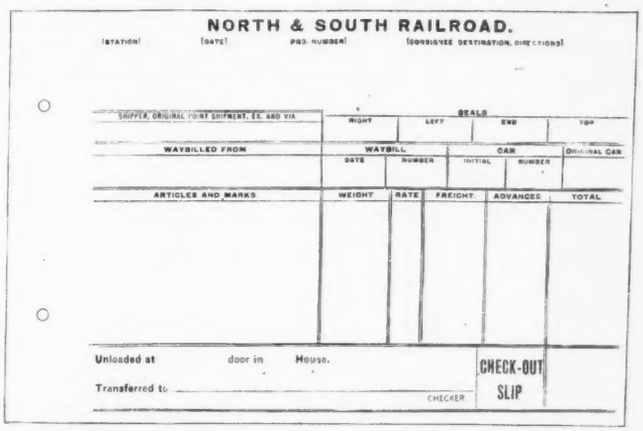


usage that such work will entail. The "Oliver" has given satisfaction.

At stations with a large volume of business the progressive numbering should be subdivided so as to separate the business into its natural divisions. This can be quickly and effectively done, either by prefixing a letter or devoting a separate series of numbers to each class. For example, "A" may designate a certain division of the local business, or all the business from that section could be numbered in series from 1 to 5,000; B, C, D, etc., or separate series of numbers might be the other divisions. "M" might designate certain line business by a certain junction, or this business could be numbered between 40,000 and 50,000, and so on to the end of the needs.

Such separation automatically brings together the records of each class of business, and thus facilitates reference and comparisons. The accumulation of the check-out slips and binding them in strict progressive order secures separate received books for each class of business. By entering the numbers on schedules the cashier is charged with each class of business, while his entering the payment in similar order makes checking easy, and comparison by totals possible. Separating the accounts allows more freedom in working without interference with one another by the clerks who are constantly consulting them.

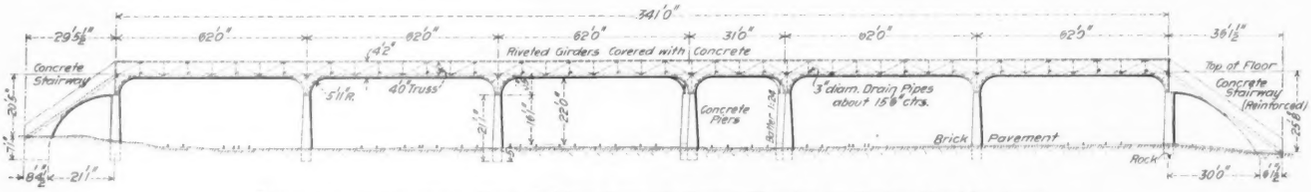
The use of this method at Warren bridge not only has demonstrated its economy and advantage, but has reduced the cost of the clerical work fully fifty per cent. With purely local bills a type-



writer operator has made 72 vouchers in an hour, and 50 an hour for seven and a half hours. With all kinds, taking everything as it comes, the average speed is about 40 vouchers an hour. With a pencil the best speed is about 25 an hour. With two machines about 800 vouchers are now made daily.

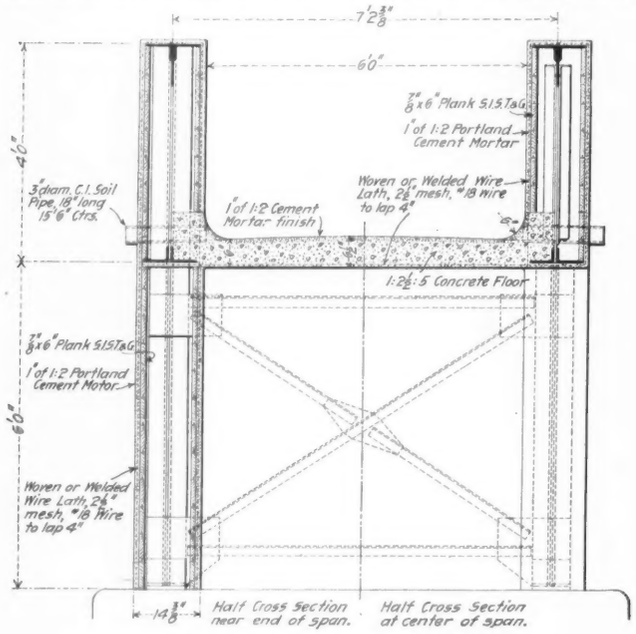
A Novel Foot Bridge.

The city of Cedar Rapids, Iowa, recently closed by ordinance "C" avenue at its crossing of the tracks of the Chicago & North-Western, the Rock Island and the Chicago, Milwaukee & St. Paul Railroads, which are side by side at this point. The same ordinance required the roads to build, in lieu of the regular crossing, an overhead foot bridge, the crossing being adjacent to the plant of the American Cereal Company and therefore requiring provision for pedestrian traffic. Mr. J. W. Schaub, Consulting Engineer, Chicago, was commissioned by the roads to design the bridge, let the contract and supervise its erection. The structure which he designed has some novel features and the plans are illustrated herewith. Mr. Schaub desired to avoid the usual steel, wooden-floor affair because of its maintenance costs. On the other hand, conditions would not permit the construction of a reinforced concrete bridge, so the design here illustrated was adopted.



Elevation of Concrete Foot Bridge Over Railroad Tracks in Cedar Rapids, Iowa.

It is a riveted steel girder bridge with concrete piers, reinforced concrete floor and stairways and a concrete protective covering for the steel work. It is 341 ft. long, c. to c. of end piers, and 7 ft. 2⅜ in. c. to c. of trusses, the walk being 6 ft. wide in the clear. It is made up of five spans 62 ft. between pier centers, one 31 ft. span between piers 4 and 5, and the reinforced concrete stairways before mentioned. Details of the steel work are not shown, there being nothing of special interest about it except that it is to be erected without falsework or field riveting, turned bolts being used in the latter case instead. Also it is to be a continuous structure, no expansion joints being provided.


7'2⅜"
60"
7"x6" Plank S.I.S.T.&G.
1" of 1:2 Portland Cement Mortar
Woven or Welded Wire Lath, 2½" mesh, #18 wire to lap 4"
3" diam. C.I. Soil Pipe, 18" long 15'6" ctrs.
1" of 1:2 Cement Mortar finish
1:2½:5 Concrete Floor
7"x6" Plank S.I.S.T.&G.
1" of 1:2 Portland Cement Mortar
Woven or Welded Wire Lath, 2½" mesh, #18 wire to lap 4"
6'0"
14⅜"
Half Cross Section near end of span.
Half Cross Section at center of span.

Cross Sections of Foot Bridge.

The protection for the steelwork is shown in detail in the cross sections. The girders are boxed in with ⅞-in. x 6-in. tongued-and-grooved material, sized one side, nailed to vertical pieces driven between the girder flanges. Wire lath is secured to this boxing, with V lath beneath to space it away from the surface of the wood in order to enable the concrete completely to surround the metal and thereby assure absolute protection to it. The surface is then plastered with 1 in. of 1:2 cement mortar, applied sufficiently dry to remain in place. The surface is afterward to be washed with two coats of grout to fill the peres and render the concrete practically impervious to gases, moisture, etc. Before covering, the steelwork is to be painted with two coats of "Nobrac."

The concrete floor is 6½ in. thick at the center and has a side drop of ½ in. for drainage, which is carried through the walls by 3-in. cast-iron pipe spaced approximately 15 ft. 6 in. on centers. To build the floor, the forms will be hung from the steel work and no obstruction will therefore be offered to the tracks below. The floor is supported on the girder flanges and is reinforced at the bottom against surface cracks with wire lath. Also it will be observed that the lath on the inner walls extends down through the floor. In erection, the floor form-supports will extend outside of the girders far enough to carry a footway to enable the workmen to plaster the outside walls at the same time as the floor is being built. The inner walls are plastered after the floor is completed, the plaster coating extending down over the floor to form a finish uniform with the sides. There are no expansion joints in the concrete work, which is monolithic throughout the 341 ft. length of the structure.

The stairways are reinforced concrete, each being a monolith. Reinforcement is provided by ¾-in. and ⅞-in. rods. The former are disposed transversely through every fourth step and have their ends turned up 4 in. to enable them to support the ⅞-in. longitudinal rods during erection. The latter, five in each stringer, are made up two different lengths, spliced, the splices breaking joints as shown in the drawings. Insurance against surface cracks is provided by expanded metal and by wire cloth, as indicated. At the top the stringers rest on pilasters formed on the end piers, and each stringer is anchored to the steel work by two ¾-in. 3-ft. bolts, as shown. A V joint is provided at juncture of stringer and bridge wall, these being the only expansion joints in the structure. The treads are given a granitoid finish. The cost of the structure will be approximately $7,500, and it is to be finished in the fall.

Statistics of Five Electric Railroad Systems in Massachusetts.

The following tables are taken from an article by Howard S. Knowlton, in the July number of *The Engineering Magazine*, entitled "A Study of Electric Railway Operating Cost and Revenue." Of the five companies whose statistics are presented four are the representative urban street railway systems of Boston, Worcester, Springfield and Pittsfield, Mass., and the fifth, included for purposes of contrast, the interurban line between Boston and Worcester. The Boston Elevated Railway Company's system is one of the largest in the world and is essentially urban. On Sept. 30, 1905, the company operated 398 miles of main track. The Worcester Consolidated Street Railway on the same date operated 139 miles of main track. Some part of this mileage is rural as the system operates in some 17 other cities and towns within Worcester County. The Springfield Street Railway operates 87 miles and is both urban and suburban in character. The Pittsfield Street Railway operates 27 miles of track and its territory consists of the urban center and outlying radial village or rural sections. The Boston & Worcester Street Railway is probably the most representative high-speed interurban line in New England. It connects the two cities named in its title by an air line route and has but two branch lines of any consequence. It operates 74 miles of main track. In the case of this road per capita statistics are omitted for the reason that if the total population of the terminal cities were included, the tributary population would be much too large, but if these figures were excluded, the tributary population would be too small.

The first table shows the volume of traffic (transfer traffic excluded) and the car mileage of each road in the year ended Sept. 30, 1905, as follows:

	Boston.	Worcester.	Springfield	Pittsfield	B. & W.
Revenue passengers	246,944,776	27,722,407	20,093,967	3,245,211	9,110,182
Car miles	48,069,404	5,079,865	4,806,894	687,299	1,820,575
Tributary population, est	972,000	245,000	129,000	31,700	.....
Do., per mile of track	2,440	1,770	1,485	1,188	.....
Rev. passgrs., per mile	620,175	199,831	230,920	121,512	123,746
Rides per capita	254	113	155	102	.....
Rev. passgr. per car mile	5.13	5.45	4.16	4.73	5.0
Employees per mile track	18.8	5.4	5.75	3.07	3.1

The second table shows the principal financial items of earnings and expenses per car mile:

	Boston.	Worcester.	Springfield.	Pittsfield.	B. & W.
Gross earnings ....Per car mile	26.4 cts.	27.1 cts.	21.1 cts.	23.5 cts.	24.7 cts.
Operating expenses	17.9 "	16.1 "	15.0 "	16.7 "	12.6 "
Net earnings	8.5 "	11.0 "	6.1 "	6.8 "	12.1 "
Wages	8.0 "	5.7 "	5.5 "	5.0 "	3.9 "
Motive power	1.8 "	3.7 "	2.8 "	5.1 "	3.3 "
Car equipmt repairs	0.7 "	0.8 "	1.2 "	2.6 "	1.0 "
Maint. of way	1.6 "	0.5 "	1.3 "	1.0 "	0.5 "
Maint. of line	0.3 "	0.2 "	0.3 "	... "	0.1 "
Legal expenses	0.6 "	... "	0.1 "	0.2 "	... "
Insurance	0.3 "	0.4 "	0.1 "	0.1 "	0.4 "
Taxes	2.1 "	2.1 "	1.6 "	1.3 "	1.8 "
Dividends	4.1 "	3.8 "	3.2 "	2.2 "	5.6 "

The Panama Railroad.*

The discovery of gold in California marks the real beginning of the history of the Panama Railroad. It was in this period that it grasped the key to the Pacific, the key that it still holds. In 1849 surveys were begun. A charter was granted to the company by the New York Legislature, and in 1850 the first ground was broken.

The struggles of Chief Engineer Totten and his devoted assistants seem more like labors in a pitiless nightmare than in a world of actual deeds. In May, 1850, 50 men landed on the marshy mangrove thicket which constituted Manzanillo Island, and began clearing. Through weary months they fought the morass and the jungle of the low coastal reaches. Totten and Baldwin took charge of the work alternately as their fever permitted. Standing waist high in the dank ooze from which steamed unceasingly the noxious miasma, veiled against intolerable insects, and drenched with tropic downpours, these steadfast scouts of Empire still persisted. More men were brought, fell sick and died, or returned to their homes; but at last, in the face of the most obdurate natural obstacles the Atlantic section of the railroad was forced through the swamp to the foothills of Gatun. Thence the construction was somewhat easier and on July 6, 1852, the line was laid to the proposed Chagres crossing at Barbacoas, the crux of the undertaking. The company, which had been doing its own construction, attempted the bridge here and failed. The contractor who next undertook the work went under before the first piers had been erected. Under a new president the company once more began its own construction with Benjamin Bates as superintendent. He erected a falsework almost as extensive as the proposed bridge, was successful, and the Chagres was crossed. Feverishly now, the railroad was pushed, lashed by the desire to participate in the golden harvest. The corners of the earth were ransacked for laborers. They came from Erin and from India. The Hawaiian Islands supplied their quota. Blacks from Jamaica were brought in every schooner. Coolies were shipped like cattle. Each day the line crept farther across the Isthmus. In January, 1854, the summit of Culebra was reached from the Atlantic side. From the other direction the line was penetrating the less formidable jungle of the Pacific slope. Jan. 6, 1855, at midnight the two ends met and next day George Totten stood at the throttle as the first locomotive crossed the Isthmus. The fight was won. After enormous difficulties, and at a cost of $8,000,000, twice its estimate, a line of rails had been carried across the 47 miles between Panama and the new city of Aspinwall. A grim legend declared that for every rail a life had been paid, but the railroad was an accomplished fact.

Trade came in an ever swelling stream. Between 1855 and 1865, $700,000,000 in specie and 300,000 bags of mail crossed without the loss of a letter or a dollar of money. Though the California business slackened with the exhaustion of the alluvial gold deposits, the trade with Central and South America increased by leaps and bounds. Receipts of freight had increased from $354,000 in 1857, to $2,738,000 in 1867 and to $3,000,000 in 1870. A new line of Central American steamers had been put on between Acapulco and Panama by the railroad company, and this, too, was bringing in a large revenue. In all the world it would have been hard to find a more prosperous enterprise.

Such was the prospect, when, in 1871, Alden B. Stockwell came into control of the Pacific Mail Steamship Line. While steward on a steamer this soldier of fortune had attracted the attention of a wealthy heiress, whom he followed to Paris and married. A few years later he was Commodore Stockwell, successor to Russell Sage as president and autocrat of the great Pacific Mail Steamship Company. He grasped control of the Pacific Mail at a time when its ownership was in feeble hands, and added to it the small Pacific line of the Panama Railroad. The sea link was then his. He reached out for the Panama Railroad, mortgaging, to secure its stock, the Howe Sewing Machine Company, his wife's dowry. He then had the land link. With nine directors in each company, he dictated the far-reaching contract by which the Panama Railroad pledged itself never in the future to interest itself in Pacific steamship business. But Stockwell was not a force to endure. His speculation and subsidy campaigns in Congress dissipated the strength that was needed to fight adversaries whose existence depended upon keeping the free seas a desert to competing ships. Startled by numerous rumors, the directors met secretly in March, 1873, to investigate the state of the company. They found that in his wider scheme Stockwell had lost control of the units. Jay Gould and the transcontinental roads had overborne him.

On April 4, 1876, the board of directors of the Panama Railroad met in New York to determine vital matters of policy. The material condition of the company was the worst since the railroad had been completed. The well-kept wharves left by the old management had fallen into decay. The seasoned superintendents had given place to raw and cheap men, who were not equal to the exacting duties. For a perilously long time no new rails had been laid, no bridges repaired; again and again freight rates on local traffic had been advanced in direct violation of the fundamental concession from New Granada. The outcome of the meeting was a formal offer made by the railroad to the Pacific Mail, of a joint rate, if it would elect a governing board not interested in the transcontinental railroads. From the critical directors' meeting called to consider this offer, Jay Gould and Sydney Dillon, still minority holders, absented themselves. The others, seeing the company threatened at either terminal, wavered for a while and finally voted to cast their lot with the Panama. Remorselessly the overland interests pursued their ends until in July, 1876, they had arranged a *modus vivendi* between their own transcontinental lines and the steamship company. By this first agreement, space on each of the Pacific Mail vessels was leased jointly by the Union Pacific and Central Pacific Railroads and $5 was paid for every overland passenger. The condition attached was that the steamer line should make such prices on freights that high-class trade would be thrown to the railroads, that they should not fill to full capacity, and should run but a limited number of ships. An assured revenue of $90,000 per month was the bait and one year only the duration of the agreement. So the first of the Pacific Mail compacts in restraint of trade was begun. Next year the subsidy was raised to $100,000 per month and the transcontinental interests were firmly in the saddle.

In 1878, wittingly or unwittingly, the Panama Railroad was betrayed to them. In a 15-year contract with the Pacific Mail Steamship Company the Panama Railroad surrendered the exclusive right to issue through bills of lading across the Isthmus. Thus at length the circle toward which the overland railroads had been working was completed. They dominated the Pacific Mail, fixing its rates and regulating the carriage of freight and passengers; the Pacific Mail, in its turn, held the Panama Railroad in the grip of an exclusive contract. With the completion of the Central and Southern Pacific Railroads by private and commendable enterprise spending lavishly the proceeds of government guaranteed or subsidized securities, there had come a crucial situation. The Panama route in its fullest bloom of prosperity was on one side, on the other side was a highly capitalized, hastily built, overland railroad, running across a sparsely settled continent, where the real support of local business had to wait a generation of immigration. The railroad had to depend for earnings on westbound through business. The eastbound earnings came in a higher proportion from passengers. To pay the expenses of operation, maintenance and interest on bonds, to create the credit needed for branches and extensions fully to occupy their territory, the transcontinental railroads had to have and hold a remunerative business.

In 1879 began the colossal tragedy of the French. The railroad company, whose line paralleled for nearly the whole distance the proposed canal channel, and whose consent by the terms of the original concession from New Granada had to be secured before a canal could be built, was in an extraordinary position of vantage. For the latter months of 1880 the French were obliged to transport their supplies at regular local railroad rates. This proved so ruinous that they determined to buy the railroad at any cost. The price was adjusted to their necessity. For 68,534 out of 70,000 shares the French company agreed to pay $18,094,000 in yearly installments with 6 per cent. interest. This represented $250 a share, far above normal value. The old directors were to control the road until the whole sum was paid. In addition cash assets were retained by the former owners, amounting to about $1,700,000, much of which had come from the French in the previous year. All told, therefore, the vendors realized $20,000,000, or $282 on each share. A dividend of 52¼ per cent. is shown by the records to have been declared in 1881.

In 1885 began the pinch. That stream of fairy gold poured into the coffers of the canal company, inexhaustible as it had seemed, was shrinking alarmingly. The railroad began to fall upon evil days, and its rolling stock and roadbed were again allowed to deteriorate. Its earning power declined; there was no surplus for dividends; everything was slipping. In 1887 the crisis came. A reorganization followed, in the canal company and the railroad. In 1889 came the final collapse of the canal company. Work had been begun on a canal to be completed in eight years at a cost of $127,600,000. When the receiver assumed the wreck of the bankrupt company, two-fifths of the work had been done, ten years had elapsed and $253,000,000 had been spent.

The ordeal through which the railroad had come crippled it beyond repair for some time to come. It was in disorganization and decay. The single-track line, 47 miles long, had fallen to the last stages of dilapidation: 24 road engines, all obsolete, less than half in good repair; 19 passenger cars; a miscellany of freight cars and switch engines; various wooden buildings; much jungle real estate and some wooden wharves at Colon completed the assets. The grip of the transcontinental roads was relentlessly exercised through the main feeder, the Pacific Mail, whose subsidy from the overland roads had amounted, in 1894, to over $18,000,000. The sum

*From an article by Lindon Bates, Jr., in *The World To-Day*.

paid by the steamship company to the Panama Railroad was roughly $12,000,000, from 1887 to 1893. From all the coast north of Panama, the Pacific Mail and the overland railroads adjusted the amount of traffic to be allowed. They arranged the Central American tariffs so that it was as cheap to carry coffee around through the straits of Magellan. They fixed American rates so that the transcontinental lines, favored already in the elements of time and insurance, could secure practically all the freight. From San Francisco to New York the fare was $90. From San Francisco to Panama, half way, the fare was $100. In order to prevent economically-minded persons from buying a ticket to New York and saving 10 per cent. of the fare to Panama, the company checked all baggage through to New York and would not give it up at any point between. Often vessels made their trip with unfilled holds at a time when freight traffic overland was at its highest. Ship after ship passed the port of San Diego. Not one would stop to take a pound of freight, all must go to the railroad terminus. The Pacific Mail frought to the Isthmian railroad no more in some years than 13,000 tons of San Francisco freight. Coffee was shipped to New York via San Francisco, New Orleans and the Morgan line, going several thousand miles out of the direct route in order to divert freight to the Southern Pacific.

The Panama Railroad stockholders could not but realize the value of the birthright they had sold in their time of need in 1893. On the expiration of the 15-year contract they attempted to break away from the restricting alliance by announcing themselves ready to make arrangements with any responsible steamer lines. But the forces opposed were of the strongest. Application was made to the Attorney-General in New York State by the transcontinental interests to force a receivership and disfranchise the stock on the ground that French control was contrary to the charter. An attempt to arrange a contract with the Chilian Steamship Line for the carriage of South American freight was held up by an injunction for three years on the basis of the old agreement of the railroad not to interest itself in Pacific business. The attempt to free the trade of the North Pacific was fought with all the power of a monopoly intrenched in vested trade interests and the possession of docks and terminal rights in every port along the coast. The fight for freedom was lost.

The officers of the railroad in 1895 signed another exclusive pooling contract with the Pacific Mail and handed the line back into bondage. The situation was cemented in the exclusive pooling contract deeding to the Pacific Mail the whole North Pacific. The freedom of the south seas was also bartered, and two foreign companies were given the right to fix initial rates here. In 1900 a half-hearted attempt was made to break loose and adopt an open-door policy. But again other interests were too strong. In 1902, with an exclusive Pacific Mail contract, the latest pool was entered into. This was the railroad situation when the sentiment in the United States, in favor of a Nicaragua Canal, began to be swung toward Panama.

On Nov. 6, 1902, the United States recognized the independence of the Panama Republic. On May 4, 1904, the possessions of the New Panama Canal Company were formally transferred to the United States. The price was $40,000,000 to the French company (of which $6,800,000 was allotted as the pro rata value of the railroad) and $10,000,000 to the Republic of Panama. It may seem ungenerous at this time to count the cost, but it is nevertheless interesting to figure the capital represented by the government investment and assumed obligations. First, there is the original price of the property; $6,800,000 was the portion of the sum paid the French which was assigned to the railroad stock, or deducting the value of the steamers, $6,532,581; $84,300 was paid for the purchase at par of other shares, and for the final 270 shares $72,120 was paid. Also there were outstanding 4½ per cent. bonds and other obligations which, figured at the usual government interest rate of 2 per cent., make the investment of the United States in the railroad proper $23,276,001.

The obvious step in defense of American commerce was to abolish the freight pools with the Pacific Mail and the South American lines, if, indeed, they did not become null and void through their violation of federal law, immediately on assumption of sovereignty by the United States. Was this done? A letter notifying the Pacific Mail of the intention to abrogate the contract was not sent until the American Commission had been in possession for seven full months and the formal abrogation did not take place for over a year after the government took control. And how much does this abrogation, so tardily executed, effect? The pooled percentage is still shared between the government railroad and the steamship companies. The initial carrier yet fixes the rates so that the whole North Pacific is still tributary to the Pacific Mail. Was the man who wrote the sophistic provision that similar terms would be granted to any other regular lines and so eliminated the great competition-makers of the sea, the ocean tramps, quite unacquainted with the utter unlikelihood of a regular line's undertaking to wrest a share in Pacific commerce from a line intrenched in every port and backed by the whole power of the Union Pacific system? Whether so or not, the naked fact remains that the United States government, far from releasing the shackles of the Panama route, continues in pooling contract with the Harriman system.

So much for the North. With the South Pacific situation there has been not even a pretense of changing the *status quo*. Instance upon instance of extortion and discrimination accomplished by the railroad's arrangements with the South American lines has been presented to the government. It was further shown that the foreign companies to whom the government has given, in a nicely expressed language of the last report of the Isthmian Canal Commission, "full authority to fix competitive rates low enough at points of origin to secure business, an agreed percentage of such through rates to accrue to this company," do in the present, as they regularly have in the past, discriminate against America in favor of Europe.

Take some of the instances cited by the representatives of South American governments in their appeal to Secretary Taft:

Nitrate of Chili cannot be brought via Panama. The combined tariff rates between the railroad company and the trust of the steamers of the southern Pacific coast fix a freight of 47 shillings sterling a ton. That same nitrate reaches New York by steamers via Magellan, paying 23 shillings a ton.

Peruvian sugar pays by the Isthmus, 30 shillings sterling a ton, and 23 shillings sterling a ton via Magellan.

The cocoa of Guayaquil, via Panama, pays to Europe from 52 to 58 shillings sterling a ton, and for New York, 65 to 68 shillings sterling a ton.

Coffee is exported from Central America to Europe, via Magellan, cheaper than by way of Panama.

The metals of Bolivar, especially tin, cannot be brought to the United States via Panama.

Frequently the case arises that products from South American coasts are imported into the United States, after being trans-shipped either to Liverpool, Havre, or Hamburg, because of the lower freight rates for Europe as against the United States.

It may be interesting in this connection to consider an interview with the chairman of the Isthmian Canal Commission reported a week after this memorial was presented. Mr. Shonts said:

"Nothing will be done that will disturb the balance of the transcontinental rates. The Panama Canal Commission will not do anything that will affect the stock of lines owned by American citizens."

This is no petty matter that can be let take care of itself. By the Panama purchase the United States entered upon its first practical experiment in the ownership of railroads. At a time when Congress is being offered the alternative of government rate-making, or government ownership for the protection of American freedom of commerce, this latest chapter of the Panama Railroad's history is of peculiar interest. The United States has become possessed of a commercial route in working order. Its 47 miles of permanent way offer no difficulties whatever compared to that of managing such a system as a trunk line. The material obstacles hampering the test are small. It is to be hoped, and may certainly be expected, that this administration, appreciating the true situation, will make the end of the Panama Railroad career as honorable and creditable as was its beginning.

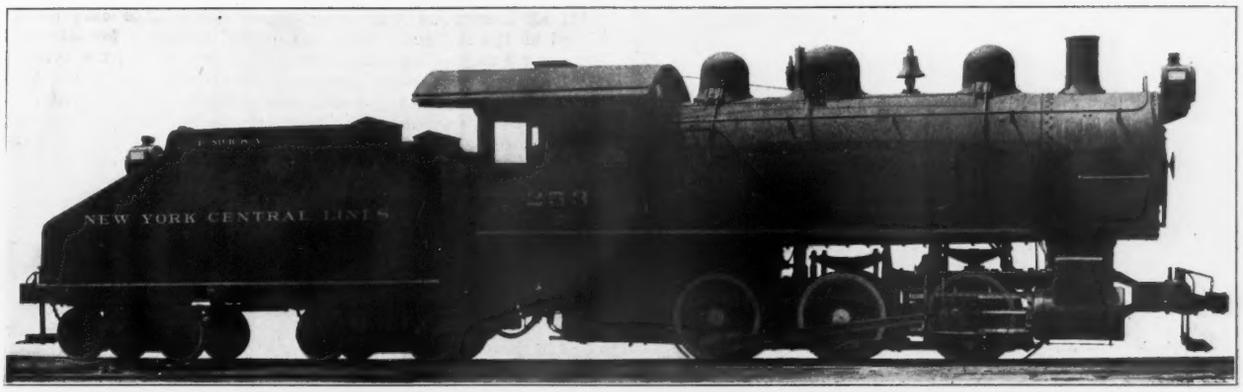
Heavy Switching Locomotive for the Pittsburg & Lake Erie.

The American Locomotive Co. has recently built an exceedingly heavy six-wheel (0-6-0) switching locomotive at the Pittsburg Works for the Pittsburg & Lake Erie. The notable feature of the engine is its size, since it is the heaviest of its type that has, thus far, been built, outranking in this respect the B6 Pennsylvania locomotive built at Altoona in 1904, which was at the time the heaviest locomotive of its class in the world. This last heavy switcher has been built to push heavy trains over the hump in the Pittsburg yard and has, therefore, been given a total weight and tractive power equal to that of the driver weight and power of the regular road consolidation locomotives so that it will be able to handle any train that is brought into the yard. Tests have shown that it can do the work of two ordinary switchers, thus greatly increasing the rapidity of work in the classification yards. Its total weight is 176,500 lbs., or an average wheel load of 29,416 lbs., which is above that of any engine of its class.

In order to carry this heavy load on each axle and still keep the journal pressure per sq. in. down to the usual limits, the driving boxes are given a length of 13 in. and the axles a diameter of 10½ in. The main reason for the use of this excessive weight on six wheels instead of eight or more was to keep the wheel base within the shortest possible limits, and this has thus been brought down to 12 ft.

The idea of this is that better results can thus be obtained on frogs, switches and curves with less danger of derailment than would be possible where a longer wheel base and more wheels are used.

As already stated there is little of novelty in the details of the engine. The firebox is carried on expansion pads instead of the buckle plates that have become the common practice of the builders. The use of side grating in the ashpan is a peculiarity, not common, but still no novelty, and the same statement holds regarding the placing of the eccentrics on the intermediate, instead of the main axle.



Six-Wheel Switching Locomotive for the Pittsburg & Lake Erie; Built by the American Locomotive Company.

The performance of this engine should be watched with a great deal of interest, not only to see whether it fulfills the expectations regarding freedom from derailments, but also as to its effect upon the track. It seems to be pretty well proven that a weight of 20,000 lbs. on a wheel will produce a very slight permanent set in the surface of the rail, and if this engine is used over any limited section of track in a way that it obtains a comparatively high mileage at a given point, the relative rate of rail wear, as compared with other places where a lighter wheel load is used, will be of value. It will also be worth while to note the effect of the inevitable pounding of so great a weight on frogs and crossings; matters that can only be determined by trial and observation.

The following are some of the principal dimensions of this engine:

Cylinder, diameter	21 in.
Piston stroke	30 "
Tractive power	44,100 lbs.
Wheel base, engine	12 ft.
Wheel base, engine and tender	46 ft. 2¼ in.
Weight	176,500 lbs.
Heating surface, tubes	2,906 sq. ft.
" " firebox	206 "
" " total	3,112 "
Grate area	33.3 "
Axle journals, diameter	10½ in.
Axle journals, length	13 "
Boiler diameter	80 "
Steam pressure	200 lbs.
Firebox, length	120 in.
" width	40 "
" thickness crown sheet	7-16 "
" thickness tube sheet	½ "
" thickness sides and back	⅜ "
" water space, front	4½ "
" water space, sides and back	4 "
Tubes, number	430
" diameter	2 in.
" length	13 ft.
Smokestack, diameter	17½ in.
Tank, capacity, water	7,000 gals.
Tank capacity, coal	10 tons
Wheels, diameter	51 in.

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} = 4.00$$

$$\frac{\text{Tractive effort x diam. drivers}}{\text{Heating surface}} = 7.74$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 93.5$$

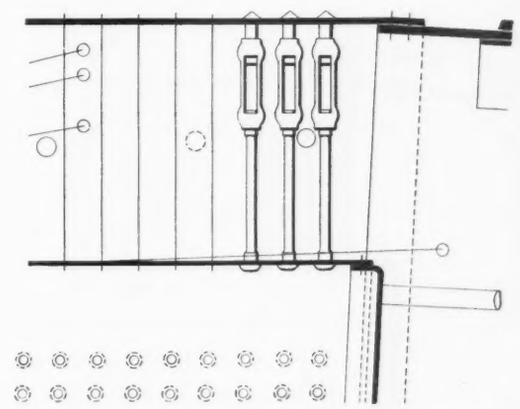
$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = .071$$

$$\frac{\text{Total weight}}{\text{Heating surface}} = 56.7$$

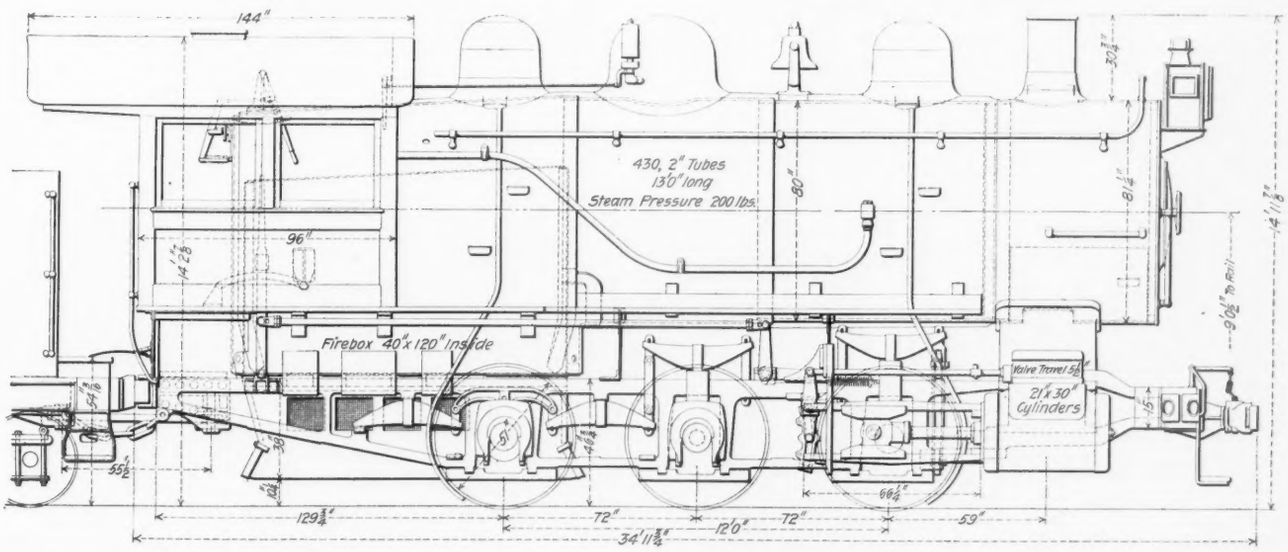
$$\text{Vol. of two cylinders} = 12.02 \text{ cu.ft.}$$

$$\frac{\text{Heating surface}}{\text{Vol. of two cylinders}} = 241.76$$

$$\frac{\text{Grate area}}{\text{Vol. of two cylinders}} = 2.77$$



Method of Staying Front End of Six-Wheel Switching Locomotive for the Pittsburg & Lake Erie.



Side Elevation of Six-Wheel Switching Locomotive for the Pittsburg & Lake Erie.

Progress of the Washington Union Station.

The new Union Station of the Baltimore & Ohio and the Pennsylvania Railroad at Washington, D. C., has been described in the *Railroad Gazette*, Dec. 4, 1903; Jan. 15, 1904; June 3, 1904, and Nov. 11, 1904. Rapid progress is being made on the building and approaches, as will be seen from the accompanying illustrations from photographs of the work taken June 18, 1906.

To simplify the work of construction the entire layout was divided into three separate parts or divisions; the terminal depot building, the north approach and the south approach. To avoid confusion with the operating departments of the Baltimore & Ohio and Pennsylvania Railroads, upon whose respective territories much of the work had to be done, the construction of the north approach and the depot building was assigned to the Baltimore & Ohio Railroad, while the south approach and a portion of the Magruder connection was assigned to the Pennsylvania Railroad.

The north approach embraces the train yard of 33 tracks, power plant, express building, coach yard having a capacity of about 750 cars, engine and repair yards with the necessary engine house and shop facilities, together with the Metropolitan and Washington branch connections for the Baltimore & Ohio and a portion of the Magruder connection of the P., B. & W. The south approach embraces the girder-covered work under the plaza, the tunnel under Capitol Hill and the connection with the P., B. & W. on Virginia avenue.

The concrete foundations of the depot building, which, over the greater portion, are about 45 ft. high, are finished and material for filling around and between them has nearly all been delivered, the fill over a considerable area reaching a depth of 35 ft. above the original surface of the ground. The granite and brick work of the east end of the building is about 90 per cent. completed, and practically all steel work in this structure being largely ball-bearing, it can only be placed as the progress of the masonry permits. There will be about 7,500 tons of steel in the building, about 90 per cent. of which is on the ground and about 75 per cent. in place, the concourse trusses, having a span of 130 ft., being all in place. In general, it may be stated that about 60 per cent. of the work on the station building is now completed.

The masonry walls forming the limits of the terminal station and north approach are all completed with the exception of short gaps near I street, through which the trains of the Baltimore & Ohio are handled. All material required to fill this space to the track levels, except in I street, has been delivered, and upon a portion of this space tracks are now being laid. A system of terra cotta conduits for the accommodation of all electric wires within the city limits is being installed, the work at this time being about 60 per cent. completed.

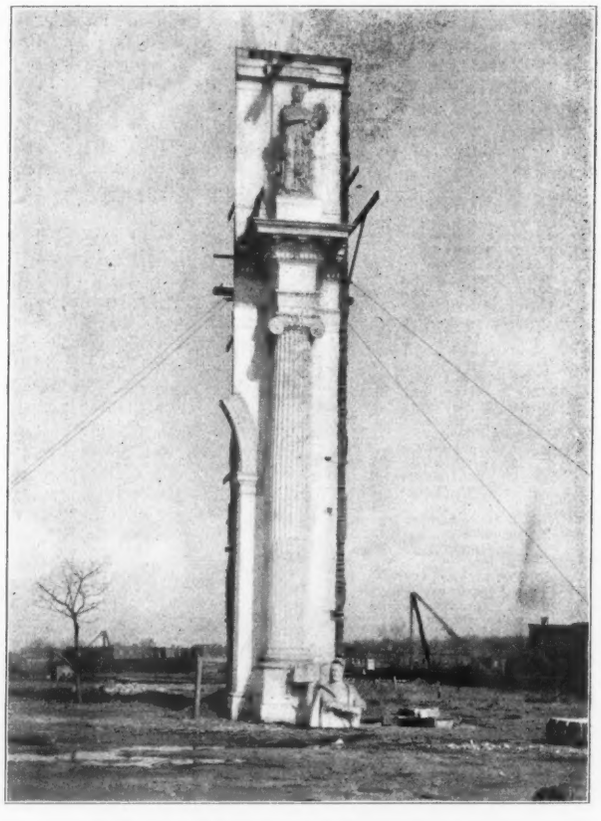
Bridges of concrete-steel construction have been erected over H, K, L and M streets and Florida avenue, consisting of I-beams encased in concrete. Upon the top of this construction is placed a layer of waterproofing material which is protected by a layer of reinforced concrete 5 in. thick. The supports for these structures are the abutments and two lines of columns dividing the bridges into three spans of 27 ft. 6 in., 25 ft. and 27 ft. 6 in., respectively, making a total span or opening of 80 ft. The spaces covered by these bridges range from 135 ft. at Florida avenue to 790 ft. at H street. The track superstructure, consisting of ballast, ties and rail, rests directly upon the floors thus formed. By this method a continuous roadbed is furnished and a water-tight roof is formed over the streets so bridged. The total area bridged in this manner is about 132,000 sq. ft., equivalent to about three acres, the superstructure alone representing an expenditure of about $400,000.

The grading for the coach and engine yards is about 90 per cent. completed. About 50 per cent. of the tracks in the coach yard proper have been laid and ballasted. The tracks on the Washington branch connection of the Baltimore & Ohio are nearly completed between Langdon and New York avenue, and seven tracks on the approach between Florida avenue and L street are laid and ballasted. The site for engine houses and shops has been prepared and bids are being asked for the construction of such buildings as will be required for the accommodation and care of the rolling stock of all roads entering Washington. These will consist of two half-circle 25-stall engine houses 95 ft. between walls, machine and blacksmith shop 80 ft. x 145 ft., oil house 30 ft. x 90 ft., store room 66 ft. x 115 ft., coaling station and sand house 24 ft. x 236 ft., two double-track depressed ashpits 250 ft. long, casting platforms 185 ft. and 330 ft., enginemen's building 60 ft. x 116 ft., cleaners' building 50 ft. x 300 ft., power houses, etc.

Uniform and satisfactory progress has been made in the construction of the south approach, a large percentage of which is tunnel and girder covered work. There are 525 ft. of girder covered work which was built in open cut. Of the tunnel work, 2,480 ft. was drifted; the balance, 600 ft. at the north end and 950 ft. at the south end, was constructed in open cut. As no shafts were allowed the drift tunneling was done from the south end. At this point all excavation was loaded on standard gage cars to be removed by the railroad. Here was located the plant for mixing concrete and handling the other materials entering into the permanent construction. This plant, including the motive power for conveying the concrete to the work, was operated by electricity. The shovel used in excavating the material removed in building the tunnel was operated by compressed air. By the use of these appliances all smoke and gases were avoided, allowing the workmen to labor under the most favorable conditions without adding materially to the cost of construction. The remainder of this work consists of cut and embankment with bridges over the intersecting streets. At the present rate of progress this work will be completed ready for use by the end of the year, though it has not been definitely decided when it will be put in service.

The quantity of material entering into such a piece of construction and the excavated material moved from one portion of the work to another is enormous. The filling, for example, within the limits of the terminal occupation amounts to about 900,000 cu. yds. To fill the plaza and raise adjacent streets to the new grade about 1,000,000 cu. yds. of material will be required. The total amount of material to be moved to prepare the site for the coach, engine and shop yards will be about 2½ million cu. yds.

The head house, 220 ft. x 620 ft., will cover over 140,000 sq. ft.,



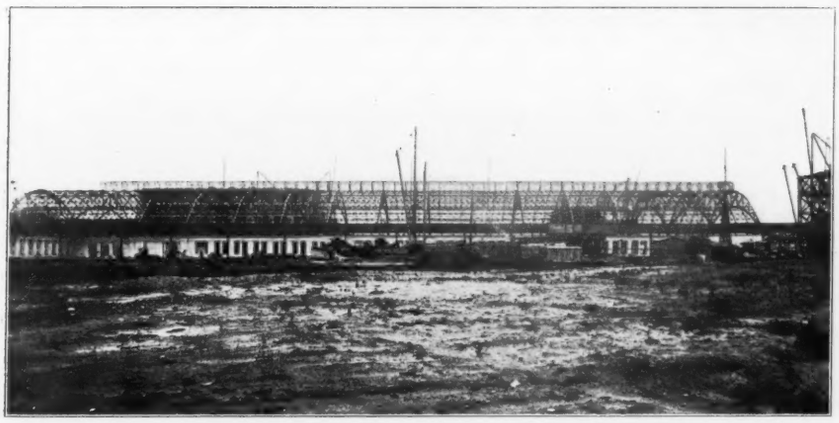
Plaster Model of Main Entrance Column.

or 3¼ acres, while the concourse, 130 ft. x 760 ft., covers an area of about 2¼ acres. The general waiting room, 130 ft. x 220 ft., will cover two-thirds acre, in itself larger than the average city depot. In addition to this room there are the usual other rooms, dining room, lunch room, ladies' room, ticket office, toilet rooms and baggage rooms.

The space which will be occupied by the roundhouse, shops and engine yard will approximate 55 acres; the space covered by the coach yard proper, 60 acres; the approach between the coach and train yards, five acres; the train yard, which will occupy the space between the north line of the concourse and L street, 31 acres; the space occupied by the station and a portion of the plaza, between the north line of the concourse and the north side of Massachusetts avenue, nine acres, making a total of 160 acres to be occupied by the terminal improvements in Washington.

On the terminal depot site there have been delivered to date about 40,000 cu. yds. of crushed stone, 50,000 bbls. of Portland cement, 20,000 cu. yds. of sand, 50 carloads of limeoid, 7,000 tons of structural steel, 426 cars of granite, 900 cu. yds. of ashlar, 234 cars of fireproofing material, 49 cars of ornamental terra cotta, and 7,000,000 bricks.

The following quantities are involved in the work done on the



Skeleton Steel Work Over Main Concourse of Washington Union Station.

north approach to date: One hundred and thirty thousand cu. yds. of masonry has been built; 2,460,000 cu. yds. of material has been excavated in the coach, engine and shop yards and deposited in the plaza, between and about the walls, around the foundations of the station and in waste or spoil banks; 170,000 cu. yds. of material has been excavated in the preparation of foundations for masonry walls, piers, etc.; 12,000 sq. yds. of waterproofing has been applied to the backs of abutments, retaining walls, etc.; 1,500 tons of cast-iron pipe has been used in connection with drainage; 16,360 lineal feet of piles have been driven; 6,415 tons of steelwork for bridges has been delivered, about 90 per cent. of which has been erected. About 6,000 tons of 85-lb. steel rail, with the necessary fastenings, has been delivered, about 50 per cent. of which is in place; 400 sets of switches and 350 frogs, 45 of which are of Manard and manganese construction, have been furnished; 10 No. 10 slip switches and 15 No. 8 slip switches, all having end frogs of Manard construction, have been delivered, practically all of which are in place. The following materials have been used in connection with the concrete-steel bridges over the various streets: Twelve thousand cu. yds. of concrete; 15,000 sq. yds. of waterproofing; 14,000 sq. yds. of electrically welded wire netting; 18,000 lineal feet of ⅞-in. rods for reinforced concrete; 13,000 sq. yds. of ⅜-in. reinforcing rods, placed 6-in. centers. In the electric conduit system about 135,000 duct feet have been put in place.

East End of Station Showing Progress of Masonry Walls.

In the construction of the First street tunnel the following materials have been used: Fifty-two thousand cu. yds. of crushed stone and gravel; 29,000 cu. yds. of sand and 60,000 bbls. of Portland cement in making concrete for the side walls and haunches of the tunnel; 8,000 cu. yds. of ashlar in the construction of the center wall and portal; 8,000,000 brick in the arches; 5,760,000 ft. board measure of timber was used in supporting the overlying material during the construction of the arches, while in the drift tunnel 92,400 cu. yds. of earth was removed. In the side walls and column foundations of the girder covered work about 4,500 cu. yds. of ashlar, 8,000 cu. yds. of sand, 18,000 cu. yds of crushed stone, and 22,000 bbls. of Portland cement were used, while the roof construction required the use of 1,048 tons of structural steel. The excavation for the open-cut work at each end of the drift tunnel was confined very largely to that removed in the preparation of foundations, as much of the actual work was built above ground and afterward covered over.

There are several points worthy of special note in connection with this construction: First, the construction of two tunnels, side by side, separated by a dividing wall but 4 ft. in thickness. The work on one tunnel, embracing a side wall and the middle wall with connecting arch, was carried on somewhat in advance of the other, after the custom in building single tunnels; the construction of the other side wall with its connecting arch then followed, completing the two-track tunnel. Second, the enormous amount of timber used in supporting the overlying material during the construction of the masonry.

The crown-bar system of timbering was first employed in the removal of the earth from the space in which the arch was to be built. Segmental timbers were then placed inside the crown-bars to strengthen the work. The completed tunnel will have, therefore, outside of the masonry, timber aggregating about 2 ft. in thickness. All cavities outside of the arch are being filled with earth.

The transportation of the various materials entering into a work of this magnitude is a greater problem than might at first be considered. There has been delivered in connection with the general terminal improvements at Washington to date approximately the following: Fireproofing material, 235 cars; stone ballast and screenings, 11,250; sand, 3,000; cement, 1,370; cinders, 5,000; brick, 1,160; structural steel for building, 380; structural steel for bridges and girder covered way, 300; granite, 425; new rail, 210; old rail, 65; frogs and switches, 105; track fastenings, 100; limoid, 50; terra cotta conduit, 25; ornamental terra cotta, 50; terra cotta pipe, 11; cross and switch ties, 530; waterproofing material, 33; ashlar, 1,900; contractors' plant, 175; coal, 800; lumber for open-cut and driven tunnel, 580; cast-iron pipe, 75; signal bridges, five; bumping posts, three, making a total of about 28,000 cars.

West Half of Main Floor Showing Progress of Fireproofing.

Arrangements are now being made for providing temporary quarters in the extreme east end of the station building, in which it is proposed to handle the passenger business of the Baltimore & Ohio. This is made necessary by the fact that space at present occupied by the Baltimore & Ohio tracks and station is considerably below grade, and will have to be filled. For this filling there has been retained sufficient material on the site of the coach yard, which cannot be delivered until the tracks are removed. To facilitate the completion of the grading in the coach yard, it will be necessary to arrange these temporary quarters.

Special Valve Gears for Locomotives.*

BY C. J. MELLIN.

As several gears in use on locomotives are derivations from others not suitable for locomotives, it may in a few cases be of advantage to go back to the origin from which they are developed and refer to others as comparisons in being applicable, but not possessing sufficient advantages for acquiring any extended adoption.

Gooch Valve Motion.—Among the latter class may be mentioned the Gooch, or stationary link motion, which might be said to be the opposite of Stephenson motion, in that the valve rod or link block is raised and lowered in reversing the engine, instead of the link in the latter. It is operated with two eccentrics set in the same relation to the crank as in Stephenson's gear, and the link is curved to a radius equal to the length of the valve rod or radius bar and turned with its convex side to the axle as shown in Fig. 1. This motion gives a constant lead and has otherwise no advantage over the Stephenson gear, except, possibly, that the link block and the radius bar are lighter to lift in reversing than the link; but it presents an objectionable feature in that the sweep of the radius bar in its raising and lowering is obstructed by the front driving axle when the main connection is made to the second or third pair of wheels, and is probably the principal reason why the Gooch gear has been in little use and is now practically abandoned altogether in locomotive service.

Allan Valve Motion.—The Allan motion (Fig. 2) may be said to be a combination of the Stephenson and Gooch gear, as the link

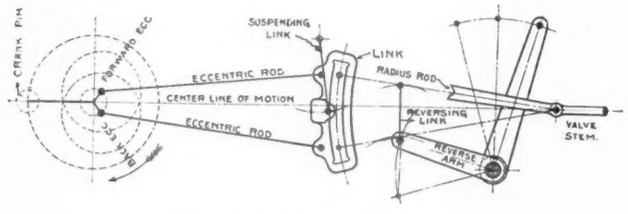


Fig. 1—Gooch Valve Motion.

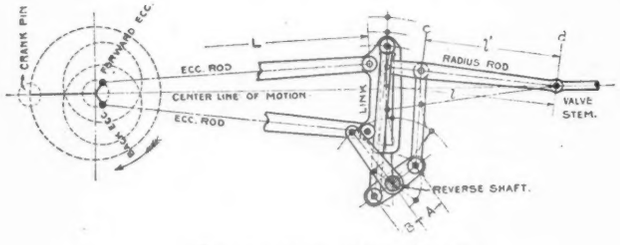


Fig. 2—Allan Valve Motion.

and valve rod are both moved in opposite directions, so that the angularities and distances in either direction are reduced to one-half of those in either of the other motions under comparison with an increase of lead, amounting to about one-half of that obtained by the Stephenson gear in linking up the engine. For this reason the Allan gear has been the favorite valve motion in continental Europe for a generation or more.

With properly selected length of lifting arms of the reverse shaft the link is made straight instead of curved as in the previous cases, which, in manufacturing in former days, was of no little importance in its favor. We see also from Fig. 2 that the lifting arms are placed on opposite sides of the reversing shafts, necessitated by the required opposite vertical motion of the link and valve rod in changing the cut-off or reversing the engine and thereby practically balancing each other and holding the reversing shaft in an approximate equilibrium at any position of the reversing lever.

These are all properties of considerable advantage over either the Stephenson or Gooch gears and deserve therefore a closer description.

From Fig. 2 we see that it is operated by two eccentrics and rods connected to the link in the ordinary way, one for the forward and the other for the backward motion of the engine, with open rods as in the case of Stephenson motion both for outside and inside admission valves, so that the lead is always increasing in linking up the engine. The reversing shaft can be located above or below the link as is found most convenient without in any perceptible way affecting the distribution of the steam. The proportions of the lengths of the rods and lifting arms are very important, in order that there may be a complete compensation for the gain of horizontal length by one rod to the loss by the others in change of angularity of the rods in linking up or down. These proportions can hardly be found by trial, but must be carefully figured out, and are found by the following formula:

$$\frac{A}{B} = \frac{l^1}{L}\left(1 + \sqrt{1 + \frac{L}{l}}\right)$$

L = length of the eccentric rod.
l = length of the radius rod.
l^1 = distance c-d in the figure.
A = length of radius rod lift arm.
B = link lift arm.
$l\text{-}l^1 = A + B$.

Although the Allan motion is the most correct one in existence

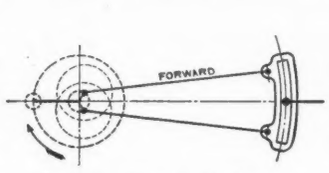


Fig. 3—Direct Motion Open Rods.

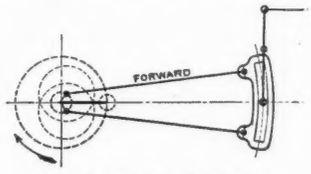


Fig. 4—Indirect Motion Open Rods.

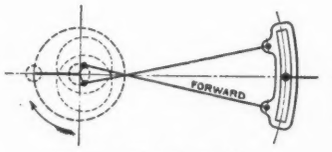


Fig. 5—Direct Motion Crossed Rods.

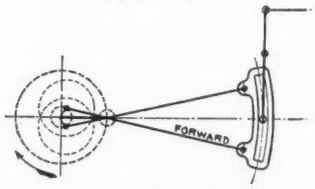


Fig. 6—Indirect Motion Crossed Rods.

it has never gotten any foothold in America, probably for the reason that it has to some extent the same objectionable feature as the Gooch in regard to the front driving axle, which, however, is not serious, as the short vertical sweep of the valve rod admits of a bend or a yoke for straddling same. As this motion is located inside the frames and occupies about the same place and is of the same weight as the Stephenson gear, on modern engines it would be heavy and cumbersome to apply, so its introduction at this time is hardly to be looked for. These conditions have also made themselves manifest in Europe, and the Allan gear, in spite of its excellent qualities, is fast disappearing from modern locomotives, being displaced by the more advantageous construction and application of the Walschaert motion, which will be referred to later.

The Stephenson, Gooch and Allan motions can be classified as one system, in that they are all based on the two eccentrics, set in symmetrical relation to the line of motion, one governing the forward but in the Allan and Stephenson it is important that the rods are always open, so that there is no reduction of lead in linking up,

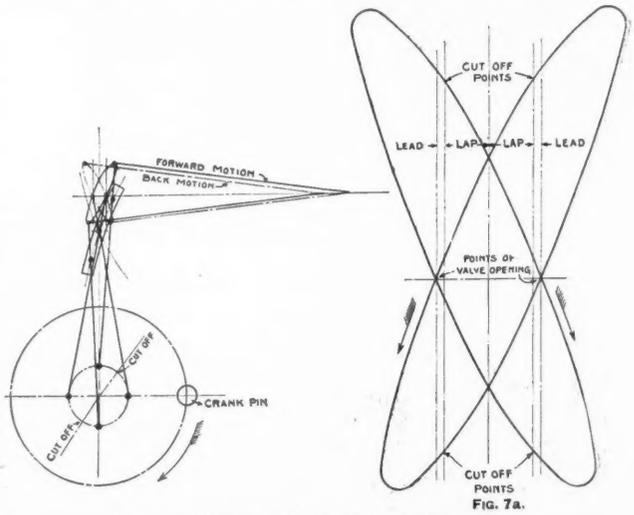


Fig. 7—Original Hackworth Valve Gear.

as crossed rods will reduce the port opening at the earlier cut-off and cause an unfavorable wire-drawing of the steam.

The expression "open rods" has therefore its definition, in that it gives an increase of lead and crossed rods a reduced lead in linking up the engine, but it may not be out of place in this connection to also define their relative positions to the crank under the various conditions of direct and indirect motions and outside and inside and the other the backward movement of the engine, differing prin-

*A paper read before the American Railway Master Mechanics' Association at Atlantic City, June, 1906.

cipally only in the matter of lead. In the Gooch gear, with its constant lead, it makes little difference if the rods are crossed or open, steam admission valves. Therefore, in a valve gear having direct motion and outside admission valve, the eccentrics at the beginning of the forward stroke will be placed between the link and the center of the axle and the crank will be on the opposite side of the axle. If in this position the upper eccentric be connected to the upper link pin and the lower eccentric to the lower link pin, we will have open rods as shown in Fig. 3 represented with Stephenson link. In a

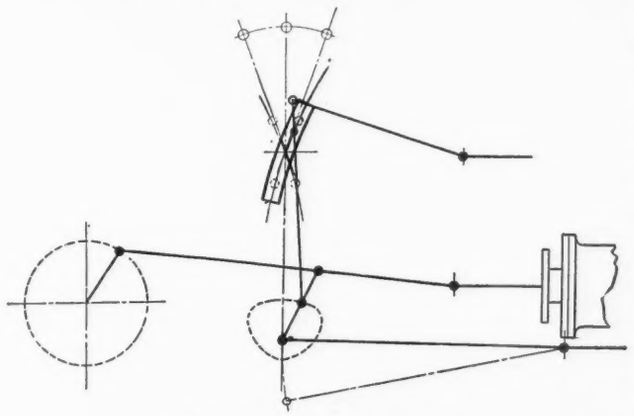


Fig. 8—Hackworth Valve Gear.

valve gear with indirect motion, the eccentrics will be placed between the link and center of the axle and the crank on its center on the same side of the axle. If in this position the upper eccentric be connected to the upper link pin and the lower eccentric connected to the lower link pin, we will have open rods as shown in Fig. 4. If in same positions the upper eccentric be connected to the lower link pin and the lower eccentric to the upper link pin we will have crossed rods as per Figs. 5 and 6, respectively. With inside admission valve we will have the crank and eccentric positions shown in Fig. 3 for indirect motion and in Fig. 4 for direct motion, and in both cases we have open rods, and in Fig. 5 indirect and in Fig. 6 direct motion, with cross rods. By this it is seen that the valve events are the same for outside admission and direct motion as they are with inside admission and indirect motion, and vice versa.

Hackworth Valve Motion.—There are various kinds of valve motions that are driven with a single eccentric, among which the oldest, probably, is that of John Wesley Hackworth, which was designed some time between 1840 and 1850, and while this type in its original form (shown in Fig. 7) is not suitable for locomotives, it is referred to as the starting point for a number of modifications, of which a few will be presented in the line of its evolution to fairly

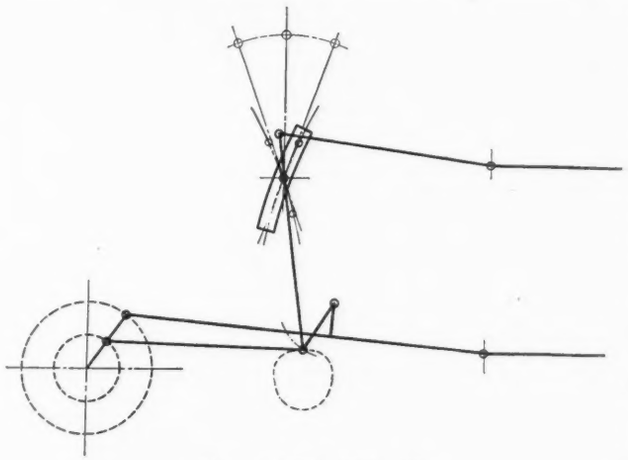


Fig. 9—Joy Valve Gear.

good valve motions for locomotives under various names of so-called "radial" gears.

The eccentric in this design can be placed either on the same center line as the crank or directly opposite, depending upon whether the valve rod connection is made between the eccentric and the link block or whether the link block is located between the valve rod connection and the eccentric. The link is occasionally made straight for very long valve rods, but is more correctly curved to a radius of the length of the rod and is pivoted on its center, while the block slides from one end of the link to the other and back at every revolution of the crank. The link fulcrum is the reversing shaft by which the link is turned to any desirable angle that will give the required throw and cut-off of the valve, and the lap and lead motion is obtained by the lever action of the eccentric arm which, therefore, gives a constant lead, whereas the opening motion of the valve is imparted by the regular inclination of the link, and the combined paths of the valve rod pin are represented in Fig. 7a in enlarged scale.

In 1859 Hackworth introduced a swinging lever instead of the link, which at that time did not seem to be brought into use, as the required length of an arm to carry same was impracticable. Mr. Brown, who has made many valuable improvements in the development of this gear, introduced a counter-swinging link, by which any radius could be obtained, but the arrangement was rather complicated and has apparently never reached any extended use until again improved upon by Klug, in 1878, and Marshall, in 1880, by practically reinventing the Hackworth construction of 1859, and the gear in that form has since been known mostly as the Marshall gear, and has to a great extent been in use on marine engines and auxiliary machinery on board ships.

Another form designed by Hackworth is shown in Fig. 8, where he attaches the eccentric rod or combination lever to a point near the middle of the connecting rod by means of an intermittent hanger, having one end connected to a return crank on the main pin to obtain a shorter longitudinal motion of the combination lever than that of the stroke of the engine, the reversing shaft being located above the center of the connection in the same way as in his previous design above the engine shaft. This was further modified by Brown, in 1878, by introducing a system of levers to reduce the swing of the combination lever, instead of the return crank.

Joy Modification.—In 1879 Mr. Joy applied this gear with a slight modification to a locomotive engine, and it is therefore generally known as Joy's gear. It is largely used in Russia and to some extent in several other countries without having gained any predominating use over the Allan motion, which, as said before, until a few years ago was the general favorite in continental Europe. Fig. 9 shows the Joy gear in a general way, and it is probably the highest development of the Hackworth motion adaptable to locomotives and gives a very good steam distribution when properly fitted up, but the effect on the movement of the valve by the vertical play of the main axle on a rough track is not entirely eliminated.

In this arrangement, as well as in the original, and, in fact, in all modifications of the Hackworth gear, the link block or combination lever fulcrum can be guided by a curved frame ("link" as it has been called on account of its similarity to the ordinary reversing links), or by a swinging link and arm of approximately the same length as the radius bar where such a construction is applicable.

No principle of valve motions has been so fascinating and subject to so many varieties of construction as that of Hackworth, and a score or more inventors have, with comparatively small modifications, found them meritorious enough to connect them with their names.

Walschaert Valve Motion.—The most suitable form of radial gear for locomotives is unquestionably the one invented by the Belgian engineer, Egide Walschaert, in 1844, and applied to locomotives a few years later, which is shown in Figs. 10, 10a and 11, but it was not properly understood or appreciated during the first twenty years following its invention, and has ever since then made slow headway until a few years ago, when it took quite a sudden move forward and is at present the dominating valve gear throughout the continent of Europe, and is rapidly gaining ground in this country, where, only within the last two years, it has been applied to engines for regular road service, although it has been in use in sundry cases, principally small engines. This gear may be said to be based on a fundamental principle of its own, but has also been subject to a few modifications without any special improvement over its original form.

The motion of the valve is derived from two sources—namely, the main crank by connection to the crosshead, and from an eccentric placed approximately at right angles to the main crank. The crosshead connection imparts the motion of lap and lead at the extremities of the stroke of the piston, at which moment the link is in its central position. Therefore, in the mid-gear with the reverse lever in its center notch this will be all the motion imparted to a radius equal to the length of the radius bar. By moving the reverse lever forward the eccentric motion is brought into combination with the motion from the crosshead, producing a valve opening for the forward motion of the engine, and by moving the reverse lever backward the link block is brought to the opposite side of the link fulcrum, resulting in a valve opening governing the backward motion of the engine, in effect similar to that of the Stephenson motion. The action of this one eccentric is therefore the same as if it was two eccentrics, one for forward and one for backward motion, placed diametrically opposite each other, and the angle of advance in the Stephenson motion is taken care of by the main crank in the crosshead connection. The latter motion being constant, it follows that the lead remains constant at all points of cut-off.

The proportions of the various parts of the Walschaert gear can-

not be determined experimentally, nor should any change in setting the valves be made unless the effect of the change is known in advance. It is therefore important that the different parts should be made and set correctly from the beginning, and there will then be no need for changes when the original dimensions are maintained. The difference in this gear for outside and inside admission valves must be considered in setting the eccentric crank and as the forward motion of the engine should preferably be taken from the lower end of the link when the eccentric crank will *follow* the main crank for *inside* admission valve (see Figs. 10 and 10a), and *lead* the main crank for *outside* admission valve. (See Fig. 11). The connecting point of the radius bar to the combination lever is *above* that of the valve for stem connection for *inside* admission and *below* the valve stem connection for *outside* admission valves. (See Figs. 10, 10a and 11). The desired maximum cut-off, lead and valve travel determines the size of the lap, and thereby the lap and lead motion ob-

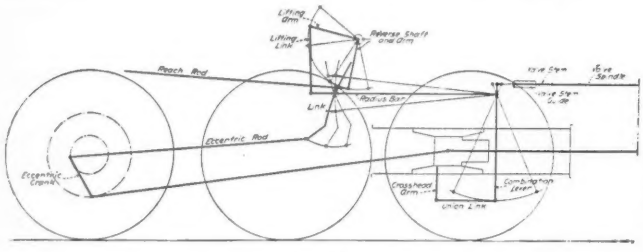


Fig. 10.

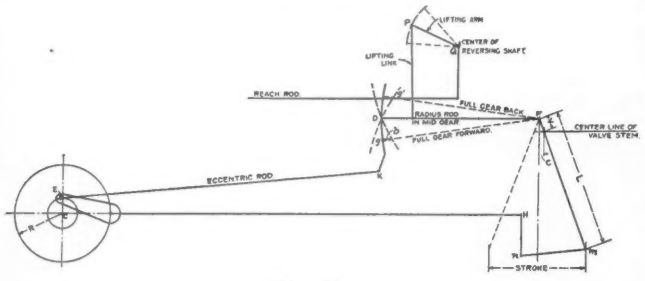


Fig. 10a.

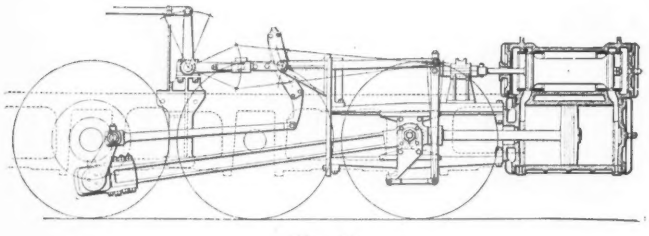


Fig. 11.

tained by the corresponding proportioning of the combination lever, and is found in the following formula:

R: C = L: V.

R = radius of the main crank.
C = lap and lead (one side).
L = distance between radius bar and crosshead connection (from F to M, Fig. 10a) on the combination lever.
V = distance between the radius bar and valve stem connections.

The length of the combination lever must be taken to suit the conditions under consideration in each case, so that the angle through which it oscillates will not exceed 60 deg., but less is preferable. The required horizontal movement or travel of the connecting point F of the radius bar to the combination lever for a given maximum valve travel must now be ascertained and is found by the following formula, in which R and C are the same as above, namely:

R = radius of main crank.
C = lap and lead.
a = half of the travel of the valve.
b = half the travel of point F.

$$b = \frac{R\sqrt{a^2 - C^2}}{R + C}$$ for outside admission, and

$$b = \frac{R\sqrt{a^2 - C^2}}{R - C}$$ for inside admission valve.

These may also be laid out graphically as per Fig. 12 for outside and Fig. 13 for inside admission valves by drawing a circle with S as a center and a as radius (shown dotted in the figures). Lay out crank radius R to the left from S = Sd and the lap and lead dimension C = Se on same side of S for inside admission (Fig. 13), and on opposite side of S for outside admission (Fig. 12). Draw ef and Sh perpendicular to Sd, when f becomes the intersecting point between the valve travel circle and the line ef. Draw the line df, and where this intersects the line Sh, which point we will call h (found by extending df in Fig. 13); Sh is then the desired dimension b in the formula, or one-half the required movement of point F, the total of which is represented by the full-drawn circle in the figures.

This is a most important function of the gear upon which prac-

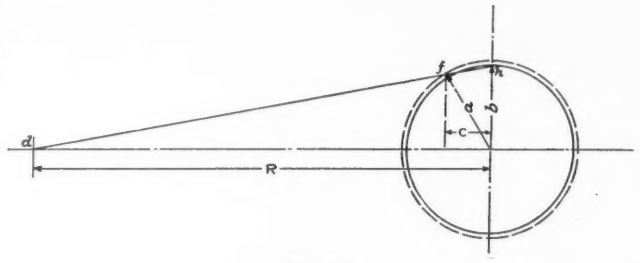


Fig. 12.

tically all the others depend, and is rather complicated to find by plotting. With a correct suspension of the link block it will have the same horizontal movement as the point F, and by limiting the angle of the swing of the link to 45 deg. as a maximum we get the rise or depression of the link block on either side of the link fulcrum the distance $Og = \frac{b^*}{\tan.\ d}$, (Fig. 10a) where O is the link fulcrum, d = one-half of the swing of the link in degrees, and b = half the travel of point f in the previus formula.

The vertical location of the link fulcrum O should be, when practicable, on a line drawn through point F parallel with the valve stem, and the eccentric rod connecting pin K to the link should be as nearly as practicable on the same level as the main axle in order to minimize the effect of the vertical play of the axle on the valve events, but on large engines it may be found necessary to lower fulcrum O and raise connection K to avoid excessive throw of the eccentric crank.

In locating the longitudinal position of the link fulcrum consideration must be given to the lengths of the eccentric and radius bars so that both may be of approximately the same length. When these lengths fall below three and one-half times the total vertical sweep

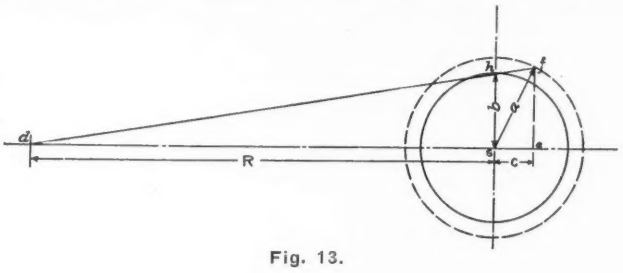


Fig. 13.

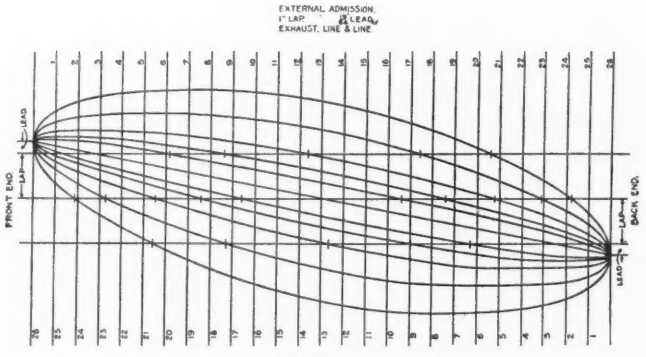


Fig. 14.

of the link block the radius bar should be favored in preference to the eccentric rod. The exact position of the eccentric crank must be plotted as well as the longitudinal location of point K. The former must bear such relation to the main crank that it brings the link in its middle position, when the main crank is on either of its dead centers and the connecting point K must be so located that it swings the link in the required angle *d* on either side of the middle position of the link; that is, in other words, the point K should be

*As no suspension gives a perfectly equal drop of the block in both link positions this formula is only approximate.

so located on the curve it must follow with fulcrum O as a center that its deviation from the tangent of the eccentric rod to this curve is such that it, as near as practicable, compensates for the irregularities brought about by the angularities of the main and eccentric rods which in ordinary cases brings it from 2 in. to 5 in. in the rear of the tangent to the link drawn through the fulcrum O.

The locus of the suspension point of the radius bar lifting link must also be plotted so that the link block is at the same point of the link in its extreme positions at all cut-offs. This locus is a curve

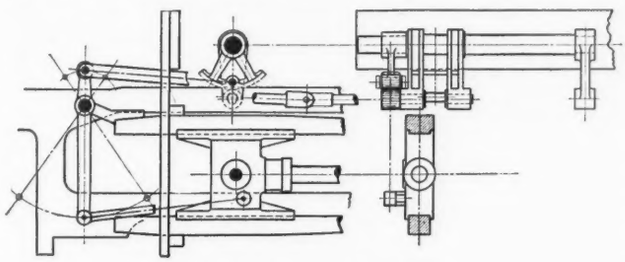


Fig. 15—Allfree Valve Gear.

with its center in the vicinity of the point F when in its mid-gear position. It would be impracticable, however, to have a lift-arm of this length, and a curve of smaller radius must be substituted and so applied that it intersects with the former curve at points giving the least possible distortion to the motion favoring the position of the link block in which it is mostly used in service.

The sliding lifter shown in Fig. 10 meets these conditions better than any other method of suspension, but, due to wheel arrangements of various designs of engines, this is not always applicable, but must be substituted by swinging lifters as per Figs. 10a and 11, which, when properly plotted, gives for all practicable purposes equally good results.

The vertical height of lower connection *m* of the combination lever in relation to the crosshead connection has a slight influence on the port opening, and should, therefore, in the center position of the lever, be about in the same level as the crosshead connecting point *n* (see Fig. 11).

In Fig. 14 is the motion of the valve graphically represented by

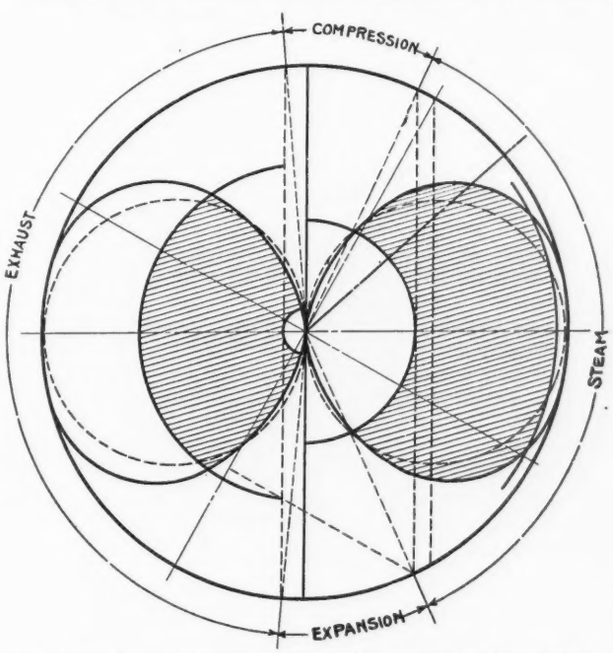


Fig. 16—Zeuner Diagram Applied to Allfree Valve Motion Attachment.

the Long diagram at different cut-offs where the horizontal lines represent the port opening edges in the cylinder face and the curves of the steam inlet edges of the valve, showing the opening and cut-off points where the latter intersect the former and the port openings at the various points of the stroke are measured by the height of these curves over and under the opening edges of the ports at both ends of the valve, respectively.

It will be noticed that these ellipses are slightly flattened on one side, which is caused by the slower lineal motion imparted to the valve relative to the angular motion when the eccentric passes its back center, compared with that of the front center, due to the angularity of the eccentric rod, and is more marked the shorter the rod. Fully symmetrical ellipses are not obtainable, as this would require the eccentric and main rods to be of infinite length, but this angularity, however, is of but little detriment to the distribution of the steam as long as the relations between the lengths of the eccentric rod and the throw of the eccentric is not less than the given limitations, and is present in all kinds of continuous valve motions derived from uniformly rotating cranks or eccentrics.

General Notes for Adjusting Walschaert Gear.—1. Ascertain by the following method the position of the eccentric crank: Mark the position of the link relative to its middle position on both of the dead centers of the main crank. If the position of the link is the same in both cases the eccentric crank position is correct, if not the eccentric crank should be lifted until this occurs or as near so as possible.

2. After the eccentric crank has been correctly set the eccentric rod should be lengthened or shortened as may be required to bring the link in its middle position, so that the link block can be moved from its extreme forward to its extreme backward position without imparting any motion to the valve. It may be noted that the link position may be observed by the usual tram marks on the valve stem, or direct by marks on the link pin as may be found most convenient with the link blocks in full gear, preferably ahead.

3. The difference between the two positions of the valve on the forward and back centers of the engine is the lap and lead doubled; it is the same in any position of the link block and cannot be changed by changing the leverage relations of the combination lever.

4. The tram marks of the opening moments at both ends of the

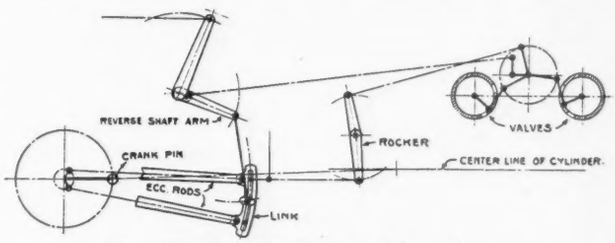


Fig. 17—Young's Rotary Valve Motion.

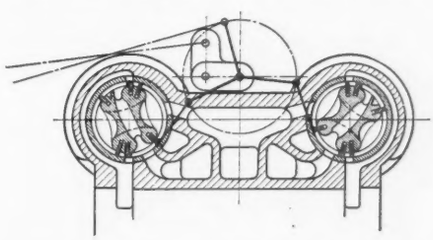


Fig. 18—Section Through Valves and Cylinders.

valve should be marked on the valve stem and the latter lengthened or shortened until equal leads at both ends are obtained.

5. Within certain limits this lengthening or shortening may be made on the radius bar, if it should prove more convenient, but it is desirable that its length should be so nearly equal to the radius of the link that no apparent change in the lead should occur in moving the link blocks as stated in note No. 2.

6. The lead may be increased by reducing the lap and the cut-off points will then be slightly advanced. Increasing the lap produces the opposite effect on the cut-off and reduces the lead the same amount. With good judgment these quantities may be varied to offset the irregularities inherent in transforming rotary into lineal motions.

7. The valve events are to a great extent dependent on the location of the suspension point of lifter of the rear end of the radius bar, when swinging lifter is used, which requires that this point should be properly laid out by careful plotting, or, if convenient, it is preferably determined by a model, as irregularities due to incorrect locus of this point cannot be corrected by the other parts of the gear without more or less distortion of same. When this point is so fixed that a change of same is impracticable it may be better, however, to modify other elements if thereby the motion in general can be improved.

The chief point of difference between the Walschaert and Stephenson gear, when both are in proper condition, is, as previously stated, that the former gives to the valve a constant lead at all cut-offs, whereas the latter produces an increase of lead by linking up the engine and becomes excessive at short cut-offs. This very point has been the subject for much controversy, and has probably done more than anything else to retard the progress of the use of Walschaert gear; as it has been argued that in full gear, when the speed generally is slow, only small lead is needed, but at higher speed more lead is required, which is accomplished by the Stephenson motion.

though this admittedly becomes excessive at early cut-offs, causing considerable compression and preadmission detrimental both to maintenance and to smooth running, and, in fact, to some degree counteracts the work done by the steam on the driving side of the piston, which thereby also affects the speed of the engine.

It was generally discovered that the required lead for short cut-off and high speed was of no practical detriment to the working of the engine in full gear, as the preadmission at that point is disappearingly small. The proper amount of lead, however, is dependent somewhat on the service, and the port opening becomes larger with a larger lead, or, in other words, when all other conditions are equal in a Stephenson or Walschaert gear the openings differ by the same amount as the lead, so that $^1/_{16}$ in. more lead gives $^1/_{16}$ in. wider port opening; but it is hardly advisable to make this over ¼ in. or $^5/_{16}$ in. as a maximum, as the advantage of any additional port opening by means of a larger lead is more than offset by the increase in compression and preadmission the larger lead would bring about at early cut-offs, and would do no good in the latter cut-offs, even if it does not do any harm.

There is no fundamental reason that the Walschaert gear should produce any economy in steam consumption over the Stephenson motion when both are in the best conditions, but an advantage in this respect comes to the former by the fact that it remains in its good condition if once made so, from one shopping to another, and is, therefore, on an average more economical both in steam consumption and maintenance of the gear than the latter. The accessibility for attention is a great point of undisputed advantage of the Walschaert gear, which is also highly appreciated by the enginemen and attendants.

It will be borne out in the course of time that the bracing between the frames permitted by the Walschaert gear will bring about a considerable reduction in the maintenance expenses by the less wear and tear this additional rigidity will impart to the entire engine.

Helmholtz Modification.—Among the various modifications of the Walschaert gear the one made by Helmholtz is probably of some advantage. This modification consists in making the link straight, and the radius bar is connected to the lifting link instead of the link block. The curving of the link is compensated for by the reversing shaft or lifting-arm fulcrum being located in a given position above the link, so that the locus of the suspension point of the lifting link forms an arc of a circle with its chord perpendicular to the center line of the radius bar in its center position. The radius of this arc bears the same relation to the length of the radius bar as the distance of the radius bar connection above the link block bears to the length of the lifting link, which results in that this connection is moving in an arc with a radius of the length of the radius bar and the same motion of the valve is obtained as in the direct Walschaert gear.

Two advantages may be claimed for this modification, of which one is the straight link being simpler to make than the curved one, and the other is that on large piston valve engines with inside admission the link fulcrum can be lowered by the amount the radius bar connection falls over the link block, whereby the eccentric rod connection can be brought closer to the center line of the axle with less length of link and eccentric throw. It has, however, the disadvantage that there is little choice in the location of the reversing shaft or lifting-arm fulcrum, a proper position for which is hardly obtainable on all types of engines and admits of no other method of lifting the radius bar in linking up or reversing the engine.

Allfree-Hubbell Gear Attachment.—The Allfree contrivance is an attachment to the ordinary Stephenson motion by which the valve is given a symmetrically irregular motion, causing it to open and close quickly, and is of special importance at high speed and early cut-off. The effect of this movement is about the same as what would be accomplished with a valve with extraordinarily long valve travel, but with a somewhat delayed exhaust and compression. The general construction of this device is shown in Fig. 15, and consists in substituting for the knuckle pin joining the valve stem to the rocker arm a small crank shaft, to which crank the valve stem is connected and the shaft left free to revolve in the rocker arm bearing. To this shaft a pinion is keyed engaging a toothed wheel sector oscillating on the rocker shaft by means of a lever connection from the crosshead. This gives a composite motion to the valve, namely, one direct from the eccentrics and one from the crosshead transmitted by the rotation of the crank on the knuckle pin shaft in such a way that the two motions coincide at the opening and closing moments, but are in opposition at the extreme travel of the valve, when the latter is nearly at a standstill, while the main crank passes through a comparatively large angle with a uniformly open port, and the closing of the valve is rapidly accelerated in the same manner as the opening, causing a quick and sharp cut-off. Fig. 16 gives an approximate illustration of the motion of the valve relative to the ordinary circular motions represented by a Zeuner diagram. The exhaust and compression are similarly affected by this alternating, accelerating and retarding motion of the valve, delaying the exhaust and compression even at early cut-offs. The advantage is, as already stated, greatest at high speed when a relatively high average pressure is obtained, which again is dependent on the capacity of the boiler. It is quite complicated to attach, especially on certain types of engines when the driving wheels are straddled by the guide yoke and thereby limiting the space required for the rocker arms and bearings.

Young Valve Arrangement.—This gear consists chiefly in the application of the Corliss valves to the locomotive engine with one valve both for the steam inlet and the exhaust at each end of the cylinder. Each valve is provided with double admission and exhaust ports, as shown by Fig. 18. The steam ports are practically opposite each other, and the relation of the edges of the ports in the valve to these ports corresponds to that of the valve edges to the steam ports of the ordinary slide valve, forming the steam laps, lead and exhaust laps or clearance as the case may be. The exhaust cavity is a passage diametrically through the valve of sufficient width on one side to combine both steam ports with the main exhaust port simultaneously during the exhaust period. At right angles to the exhaust passage is a similar but somewhat larger cavity which corresponds to the steam chest with transverse passages through the valve body alternating with the exhaust passages, and the lap and exhaust edges are surrounded by carefully fitted slats, both on sides and ends to prevent leakage.

The motion is transmitted through a pivoted wrist plate to the valve from an ordinary Stepheson valve motion as indicated in Fig. 17. By means of pivoting the wrist plate on the arm of a bell crank whose other arm is connected with a union rod to a short arm on the reverse shaft, the wrist plate is raised and lowered by the motion of the reverse lever producing a moderate increase in lead, an earlier exhaust and later compression than the direct Stephenson motion produces in linking up the engine.

The main advantage of this valve is the quicker admission, closing and exhaust it accomplishes due to the double port openings, and the small resistance it offers to the valve motion, as compared with the slide valve, in being completely balanced. In common with the Allfree gear it gives a higher average pressure at high speeds than the ordinary valve and in a general way the illustration showing port openings in Fig. 16 is applicable also to this valve and gear. This gear, as well as in the previous case, involves additional complications over the ordinary gear, requiring special skill, both in its manufacture and adjustment, which to some extent counterbalances the above-named advantages.

The Use of Form 19 for Superior Trains.

BY H. A. DALBY.

At the recent convention of the Train Despatchers' Association of America, held at Buffalo, one of the interesting questions discussed was the use of the "19" order for all trains, superior as well as inferior. There were present members from single-track divisions of the Lake Shore and Pennsylvania, where this is the daily practice, and a number of other single-track lines are using it in this manner. With proper signal equipment at telegraph offices, and especially in conjunction with the "middle order," it has proved highly satisfactory, and the advantages gained over the usual method, that of requiring the conductor, and possibly the engineman, to go to the office and sign the 31 form, are certainly great.

There should be a special form of train-order signal, or an auxiliary to the regular signal, to indicate to the approaching train that a "19" order is to be delivered. The three-position signal has been suggested for this, using the caution color of the middle position of the arm for such indication, but this does not appear to commend itself as does the practice on the Lake Shore, where the signal is kept in the "stop" position and the operator goes to the platform and displays a white flag or light. On seeing this, the engineman reduces speed low enough so that the order may be delivered to himself and the conductor. A whistle signal would also be useful; the engineman could then notify the conductor to be prepared. This would be almost a necessity in the case of vestibuled passenger trains, on which some little time is required for a trainman to get to the steps.

The success of this use of the "19" order depends on the question of certainty in delivery. This is accomplished by the use of clearance cards under suitable regulations. The rule should be that when the train-order signal stands at "stop" no train may leave the station without a clearance card. This clearance card must show the number of each order delivered; or, if there are no orders, that fact must be stated. An additional feature of safety may be added by requiring that the operator check over with the despatcher the numbers of the orders to be delivered and receive the "O. K." or "Complete" to the card. The despatcher records this in his book and all concerned have a complete record. The train is not stopped, and the wire work consumes much less time than the process of getting and transmitting the conductor's signature.

The operator may be required to put down a torpedo as an additional stop signal, or a green flag or light may be used by him instead of the white. The "X" response may be applied to the 19 in the same way it is now used for the 31. Hoops may be provided in

which the order can be fastened and safe delivery be thereby practically assured.

While the chief advantage is avoiding stops there are others. With Form 31 a fast passenger train must, in many cases, be "fixed" at its initial station with all the orders it will need over the whole district, and this, many times, on very uncertain information as to whom it will leave. By the use of Form 19 a restricting order could be sent to any station. Such a train gets orders which are to be executed 30 to 50 miles from where they are received, and sometimes they are forgotten. By this means they may be given only one or two stations in advance. The danger of a train running past a red signal is lessened by requiring the operator to be on the platform, where he can detect any indication of such oversight, and use his hand signal to effect a stop. When using Form 31 he remains in his office and is unprepared for such emergency.

Lower Passenger Fares on the Pennsylvania Railroad.

Fourth Vice-President Thayer of the Pennsylvania, in charge of traffic, on July 31st issued the following official statement:

The Pennsylvania Railroad Company on Sept. 1 will place on sale 1,000-mile tickets at the flat price of $20, or two cents a mile, and these tickets will be valid on all its lines east of Pittsburg and Erie. The interchangeable mileage book, at present the only form of mileage sold by this company, is valid over six railroad systems besides the Pennsylvania, but is non-transferrable, and, therefore, requires a deposit of $10 to guarantee its exclusive use by the purchaser. The new ticket will be accepted for travel upon this company's lines only, upon presentation by anyone, making it available for use by individuals, firms, families or associations.

The management has also decided to reduce the maximum one-way fares to 2½ cents per mile upon all passenger traffic east of Pittsburg and Erie, although under its charter the company has a right to maintain a charge of 3 cents per mile for through passengers and 3½ cents for way passengers. As the inauguration of this policy will involve a vast amount of preparation, the exact date when it will go into effect cannot now be determined, although it is expected this will not be later than Nov. 1.

This reduction of fares has been the subject of serious consideration for a year past. For many years, as is well known, the company, at enormous expense, has been increasing and improving its equipment and facilities for passenger travel, adopting every modern device to protect the lives of its passengers and to provide the maximum of comfort and convenience upon its trains. It has also expended large sums to build relief lines upon which freight trains should be moved, that this class of traffic might be diverted from the present main lines and thus secure less liability for delay to the company's largely increased passenger service. The company has believed that the time would come when a much larger traffic could be handled profitably with a reduction of the present rates of fare.

A reduction so far-reaching in its consequences could only be entered upon after all possible elements and forces had been considered and thoroughly weighed. Nevertheless, the decision to take this step here indicated was practically reached last February. In view of the pending litigation at Harrisburg concerning the interchangeable mileage tickets, it was deemed advisable that the announcement of the company's purpose in this regard should be deferred until the decision of that case, which it had been confidently expected would have been reached before this. As it is now evident that this case cannot be decided until late in the autumn, the company has determined to postpone this announcement no longer.

The present interchangeable mileage ticket, provided the other railroads interested are willing, will be continued on sale.

The Trans-Andine Railroad.

BY MAJOR J. ORTON KERBEY,
Ex-Consul to Para.

South America is a wonderland, especially the part of it called "The Land of To-morrow." There are a thousand times more marvels in it than Captain Mayne Reid told. But the marvels don't make good ballast for railroad track, except on paper.

Much of the Pan-American literature that is being palmed off on the trading public of the three Americas, when Brazil, for example, is the topic, reads very much like a Jules Verne story to one who is on the spot; and a weird suspicion forces itself upon the reader that the "pan" attachment is principally for "scooping" purposes. The great "Pan-American Railway" is a beautifully taking conception. The American eagle shivers in every pin feather, and his teeth chatter with delight at the mere suggestion. But however glorious it may be for the great American eagle, when the average American citizen proposes to send his own private ten-dollar eagles a railroading, he wants to know how it is going to pan out and where the "pan" is going to dump after the "scoop" is made, and where the eagle is going to light when he comes down.

Not long since my attention was called to certain articles published on this subject, whose author has the reputation of knowing pretty near all that is worth knowing about South America, and which treated especially of the most necessary and most promising of Pan-American railroad schemes, as he thinks. The roads which he suggests, or some of them, would be situated so that they might be utilized as part of the great Pan-American Railroad, if that is ever built.

"If?" some reader may exclaim, "why, of course it will be built."

A continuous line of railroad may some time in the far distant future be in operation from New York to Buenos Ayres; but it will never be used for carrying through freight between those points. As long as half an ounce of coal can be made to move a ton of cargo a mile on the open ocean, no born Yankee is going to send his freight by rail to the Amazon Valley, or to Rio or to Buenos Ayres. The Pan-American Railroad will never be for Pan-American trade. An ocean steamer can beat a freight train by 50 per cent. as to speed, and by greater difference in cheapness of carrying. Consequently, it is nonsense—excuse me, it is poetry—this Pan-American Railroad dream.

It might become quite interesting for the American tourists in a parlor car to be whirled through a series of different revolutions as they passed through various countries. The trains might make as good time as tramp steamers, provided we did not introduce railroad strikes and riots with our reciprocity and railroad management.

The Land of To-morrow has 50,000 miles of available river navigation; and by building six or seven hundred miles of railroad to get around the rapids of the Madeira, Tpajos and Tocantins rivers, several thousand miles more would be added to Amazonian navigation, and unite the Plate and Amazon valleys. With 50,000 miles of water way, every man can have a steam boat at his front door, as often as he needs it, the year around.

There is only one steam railroad in the Amazon valley, the Braganca Railroad, running out 40 miles from Para, on which trains of two cars run regularly on Tuesdays and Saturdays. This road has never paid half of its running expenses; the deficit is paid by the state. The trouble is that in the greater part of South America there is no population back from the rivers and the coast to support a railroad, except in a smaller part of the country. In nearly all the rest, back from the river margins, there are forest-covered mountains. What lies back of these mountains is still as unexplored as the interior of Africa and perhaps more profitable to us and as interesting as Stanley's Equatorial Africa.

When the high lands of the interior are peopled they will need railroads to give them communication with the water courses, which will always be the great trunk lines of communication of South America by Amazon and Plate.

Except on extensive plains, the rule of railroad building is to follow the water courses, where nature has already done all the necessary grading. When a range of mountains or of hills is to be crossed, the road follows a valley up to the summit and descends the other slope by another valley. To follow the course of the range of the Andes, tunnelling the spurs and bridging the mountain valleys, is to multiply by one thousand the cost of building. But that is just what is done in much of the present railroad building on paper in Pan-America.

The water shed between the Amazon basin and that of the River Plate is a mountainous region, and its flanks are out on either side by the valleys tributary to the Amazon and Plate rivers respectively. Still the Pan-American Railroad dreamer proposes to shove a railroad more than 5,000 miles lengthwise through mountains from Panama to Patagonia, cutting at right angles every valley and hill for thousands of miles, through a nearly uninhabited region, the greater part of the distance.

The two objects proposed are to reach the possible mineral wealth of the region to be traversed, and more especially to give to South America communication with North America via Panama, Central America and Mexico. It is perfectly safe to predict that no railroad will be built along that route very soon. The natural outlet of that part of South America is two weeks nearer to Europe and the United States than the one proposed. A short railroad past the rapids is the solution of the problem.

The same writer has another railroad "castled in the air," to run from Manaos, on the Amazon, across the country to Paranaribo on the coast of Dutch Guiana. The distance is an insignificant 1,000 miles. Nothing would have to be paid for "right of way" for there is no one living on the route, and no one has ever been over the ground, so that it is impossible to prove that the plan is not feasible. There is a range of mountains to cross, but the writer has the general direction of water courses in his favor. He is crossing the mountains, and not riding them astraddle as in the southern plan.

But the great puzzle is to know what use the Trans-Adine Railroad could be put to after it were built. He thinks that it would give quicker communication with North America; but that is an enormous mistake. Ocean steamers sail direct to Peru, three thousand miles up the Amazon, the year around. They could make the distance from New York to Iquitos, via Para, and Rio and Buenos Ayres, in 30 days, and be there as soon as his overland train, with much less than quarter of the expense, and with no reshipment of cargo, the cargo going unbroken by steamer from points on the Amazon and affluents three to four thousand miles in the southwest. The whole scheme seems a desperate attempt to dispense with the 50,000 to 75,000 miles of Amazon and Plate river navigation by carrying the products from five to ten thousand miles overland.

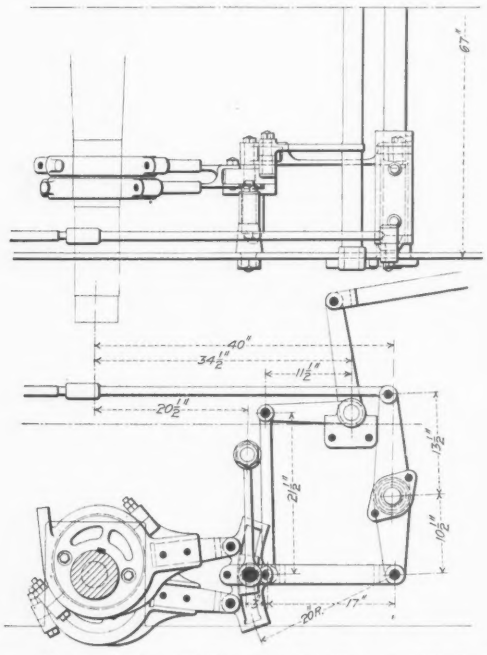
But the Amazon will not be dispensed with. It has not only the

right of way, but will hold it exclusively. No railroads need apply. They can't be built down the valley proper, for the river rises 30 ft. or more annually, and overflows its plains, changing its channel, tears out its islands, builds others and plays the mischief generally. At low water, this year, where last year there was a forest with trees 60 ft. high, a steamer may find 15 fathoms of water.

Over the bluffs that flank the flood plains a railroad would have to tunnel and bridge without end, and on crossing the tributaries of the Amazon there would have to be Firth of Forth bridges miles long built on mud 50 ft. above low water mark; for these tributaries annually rise from 30 to 40 ft. and overflow their flood plains for miles on each side. The Amazon will never allow an east and west railroad as its rival, nor allow itself to be bridged after it leaves its cradle in the Andes.

There are railroads to be built, however, as already indicated, to pass the rapids of the rivers Tocantins, Tapajos and Madeira, to unite the thousands of miles of the Plate valley to the Amazon. These three short railroads will add immensely to the wealth and resources of "The Land of To-morrow," for the territory thus opened up is habitable and very rich in its soil, forest, pastures and mines. None of these railroads is now contracted for, although two of them have been in the past.

The Madeira & Mamore Railroad, for passing the rapids of the Madeira river, was a most disastrous enterprise. Fortunately, for Brazil, she was not to blame for the failure. P. & T. Collins, of Philadelphia, were the contractors for building the road. English stockholders laid an injunction on the funds and the work stopped. Five miles of finished track, several ship loads of rails, locomotives and other appurtenances still lie in the forests at Santa Antonio, on the Madeira, where they were abandoned 25 years ago. (See paper by O. F. Nichols in the *Railroad Gazette*, Jan. 1, 1904.)



Gooch Valve Motion for Manitou & Pike's Peak Railway Rack Locomotive.

Twenty years ago the Brazilian Government sent a commission of civil engineers to survey the route. After returning to Rio, there were charges of "sham survey," etc. The Commission quarreled, the survey was pigeon holed and is still there where it was 20 years ago.

The Alcobaca Railroad, on the river Tacantins, has fared no better; present prospects are dubious, although the Brazilian Government is promising that it shall soon be built. It was to have been built by the Para Transportation & Trading Company, an organization chartered by the state of Wisconsin. This company obtained the first choice of large tracts of land at a nominal price, exclusive privileges for the road for 90 years, and other advantages. The grant was obtained in a marvelously easy manner, to all appearances. But just as the company were about ready to begin actual operations the governments suddenly and rather mysteriously voted repudiation of part of the privileges. The bad faith implied in this partial repudiation caused the company to abandon everything and let the grant collapse by neglect.

If the history of the different railroad construction and trading companies could be written out in full, both on the side of the companies and on the side of the governments, it would in all probabilities serve as a most valuable guide for future railroad contractors in South America, as to what ought not to be done by either business men or governments under any circumstances. Colossal bad faith is the mightiest obstacle that hinders railroad building.

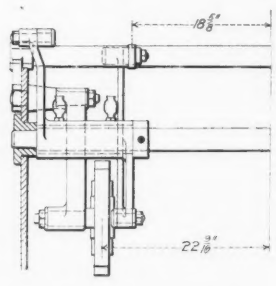
The writer believes that when, or if, the Trans-Andine Railroad is ever built, it will be operated by electricity instead of the steam engine. This power can be obtained in the greatest abundance all along the route, from the melting snows on the peaks of the Andes, which create immense water falls in all the valleys or numerous canyons, in sufficient volume to generate electric power, to not only operate the Trans-Andine Railroad, but all the other power plants that may be required along the route, from the waste or overflow.

There is no coal or fuel on the proposed route, the transportation of which from a distance would make its use almost prohibitory, and as a great part of the line would be located at the unusual altitude of 16,000 to 18,000 ft., or nearly three miles above the level of the sea, under atmospheric pressure that renders breathing difficult in the rarified air and where water does not boil, it would seem to offer difficulties in the way of the working of the piston from a steam pressure as well as of engineering problems.

Gooch Valve Gear on Rack Locomotive for Manitou & Pike's Peak Railway.

In the issue of the *Railroad Gazette* for July 13 the rack locomotive for the Manitou & Pike's Peak Railway, recently built by the Baldwin Locomotive Works, was illustrated and described. A further illustration of the arrangement of the valve motion of the engine, which is of the Gooch, or stationary link type, is given herewith.

This motion is never found on American locomotives of the ordinary type, and is used in this country only where the space beneath the engine is very limited. The peculiarity of the location of the link, with its back or convex face toward the eccentrics, is the most noticeable feature, and will serve to attract attention to the arrangement at once. Ordinarily it is used without a rocker, for the radius bar serves as a satisfactory means of direct connection between the link block and the valve stem, in nearly the same manner that it does in the Walschaert gear. In the cost of this engine, however, a rocker with arms proportioned 10½ to 13½ in. is used. The link is of a very short radius, equal to the length of the radius bar, or 20 in., though it is evident that this may be of any dimensions suited to the particular engine for which it is designed.



The link is hung from a fixed point by a link hanger, as in the Stephenson motion, but is not moved in the reversal of the engine. This is accomplished by raising and lowering the radius bar with the lifting shaft and reversing link as indicated by the drawing.

It has frequently been customary to state that with this type of link the lead is constant. As a matter of fact the lead angle increases as it does for the shifting link. "The difference between the two is that the lead opening of the stationary link motion is more ample and the angle slightly greater, for all except the mid gear, than with the shifting link motion. Unlike the shifting link motion, however, the lead opening is not dependent on the arrangement of the eccentric rods, for these may be either crossed or open without altering the result."

Foreign Railroad Notes.

Presses are running day and night to print the many millions of tickets which will be required by the German railroads after July, to satisfy the requirements of the new ticket tax law.

The gage of the Spanish railroads is 5 ft. 6 in. Negotiations have been recently made between France and Spain looking to the laying of a third rail from the frontier station at Port Bou, at the Mediterranean end of the Pyrenees, to Barcelona, and at the Atlantic end from Irun to San Sebastian, which will make it possible for cars from the French railroads to reach considerable Spanish towns, instead of only border custom houses, as at present.

The *Journal* of the German Railroad Union of June 23rd has an article a page in length on the life and services of Johann August Röbling, called out by the one hundredth anniversary of his birth on June 12th last. This is our John A. Roebling, who certainly is not forgotten, and never will be forgotten, by American engineers; but whose anniversary was probably not so well remembered in the United States as was done by this article in a German newspaper. The country which gave him birth and educated him has been more mindful than the country which he served so long and so well.

GENERAL NEWS SECTION

NOTES.

The Indiana State Tax Board has increased the valuations of railroad property about $12,000,000 over the total for last year.

The Montana State Board of Equalization has increased by 12½ per cent. the rate of assessment of railroads in that state for taxation; that is to say, from $14,500 a mile to $16,236.

The Trades League of Philadelphia announces that about 40 excursions of merchants from the West and South are coming to that city this summer and 20 have come already. Most, or all, of these excursionists have reduced-rate tickets to New York City, but they have the privilege of stopping over at Philadelphia.

The last company to announce that it has never killed a passenger on its trains is the Missouri, Kansas & Texas. The company was organized in 1870. A similar statement has been made concerning the Canadian Pacific lines west of Winnipeg. The Canadian Pacific main line through to the Pacific coast was opened in the year 1886.

The management of the Intercolonial Railway has issued a circular informing employees that hereafter they can have only one pass a year, and none at all for their wives—from which it appears that working for a railroad operated by a benevolent government is not all that it is cracked up to be—especially when there is no Election Day approaching.

An officer of the Pennsylvania, replying to newspaper complaints that the road was favoring Baltimore at the expense of Philadelphia, says that the company's grain elevator capacity at Philadelphia is being increased. Elevator A, at Girard Point, is being torn down to make room for other facilities, but this elevator has been practically out of service for several years and room in other elevators is now available, so that the company expects to handle at that port 750,000 bushels more grain than last year.

At Calhoun, Ga., one day last week there were 8,000 crates of peaches lying around on the ground in the vicinity of the railroad station waiting to be shipped, but with no cars in sight. At other points in Georgia, according to the local papers, the same scarcity of cars exists, and, in addition, there is too much rain, causing the peaches to rot. The prayers heard in the churches in that region are, therefore, for less rain and more refrigerators. On the Chattanooga Southern Railroad, it is said, 10,000 crates of peaches were thrown into the river because of lack of cars.

The railroads between the Missouri river and Chicago, which for two or three weeks seem to have been doing their best to get up a grain rate war, have agreed to restore all tariffs, according to one statement on August 11 and according to another on August 26. The Chicago Great Western having reduced to 10¾ cents the rate on grain, and subsequently made the rate on flour 2¾ cents less than that on grain, the other roads, one after another, made similar reductions, and the announcements by the different lines followed one another in bewildering succession, but after a few days the "contest" was reported settled.

Press despatches from San Francisco on Tuesday of this week report the blockade of freight at and around that city as worse instead of better; although by strenuous efforts and by "missionary work" among the consignees, many hundreds of cars had been unloaded during the past week; and the Southern Pacific announced that until further notice only foodstuffs, perishable goods and crude oil would be received for San Francisco. The number of loaded cars in the yards of San Francisco and Oakland was estimated at 5,000. To keep the peace with the workmen in the freight houses of Oakland the Southern Pacific was compelled to advance their pay to 25 cents an hour. Mr. Kruttschnitt is at San Francisco.

The General Manager of the Metropolitan Street Railway, which operates the surface street car lines in Manhattan, New York City, speaking to a reporter, says that the rule to forbid smoking on street cars is poorly enforced because the public—that is to say, the passengers—do not give to the conductors the moral support necessary to carry out such a regulation. The rule which prohibits spitting has, however, produced a marked improvement in the habits of passengers, and for the reason that the company secured the backing and co-operation of the Board of Health. After getting the board interested in it "our way was easy; once we had the prestige of a municipal department behind us, most of our troubles ceased."

A German newspaper correspondent at Tokio, speaking of the proposition to put all of the railroads of Japan into the hands of the Government, says that the people have abundant reason for disapproving of the scheme, for the reason that one branch now belonging to the Government—that from Tokio to Kobe—is a model of mismanagement. Sleeping accommodations must be reserved days ahead; the cars, even those of the first class, are overcrowded, and the officials are careless about attending to their duties. There is no consideration for non-smokers, though the natives of both sexes smoke incessantly. Heating and lighting are of the most primitive description. It is feared that state control will reduce all the roads to this level, and that the rates will be raised, as a new form of taxation. The value of competition is illustrated on the line from Tokio to Yokohama, which, for the first time, has put on real express trains that cover the distance in half an hour, the cause of this new departure being a rival electric line.—*New York Evening Post.*

National First Aid Association.

This association held its first annual meeting at Boston June 7, and the report of the meeting has just been issued. It contains brief articles showing what has been done in the way of instructing railroad employees and others in first aid to the injured in Maine, Massachusetts, New York, New Jersey, Michigan and Virginia, and much other general information on the subject. Lists are given of physicians who have given lectures on this subject in these states and also in Indiana and the District of Columbia. The Secretary of the Association is Miss Mary I. Kensel, 6 Beacon street, Boston.

Railroad Records Under the New Law.

The Interstate Commerce Commission has notified the railroads of the country that they may continue keeping their accounts, records and memoranda according to their own plans until the Commission prescribes a method or methods. Attention is called to the fact that annual reports of railroads must be filed on or before September 30 of this and subsequent years unless additional time is granted by the Commission.

Large Gas Engines for Gary, Ind.

The Westinghouse Machine Co. has a contract for eight large gas-driven blowing engines to be installed in the United States Steel Corporation's plant to be built at Gary, Ind. This type of engine will also be used for generating electricity. Each engine, as an electric unit, will have a rated capacity on blast furnace gas of nearly 3,000 h.p., corresponding to a rating of 4,000 h.p. on natural gas. The unit will be arranged in twin tandem fashion, each side consisting of two double acting gas cylinders and one blowing cylinder in the opposed or "vis-a-vis" arrangement. Power cylinders are 42 in. and the air cylinders 68 in. in diameter, with a common stroke of 54 in., the unit running at a maximum speed of 75 r.p.m. for blowing and 84 r.p.m. for electric work. The capacity of air delivery at this speed will be 33,000 cu. ft. of free air per minute at 18 lbs. pressure, with a maximum pressure delivery of 30 lbs. per sq. in. For several months a 350-h.p. engine of this type, installed largely for experimental purposes, has been in regular operation on blast furnace gas at the Edgar Thomson Works, Pittsburg, generating electricity for motor-driven foundry machinery.

Manufacturing and Business.

E. N. Chilson has been appointed Purchasing Agent of J. G. White & Co.

J. W. Strahl has been appointed Superintendent of the works of the Dayton Pneumatic Tool Co., Dayton, Ohio.

Henry M. Steele, until recently Chief Engineer of the Central of Georgia, has been appointed Chief Civil Engineer for J. G. White & Co., of New York.

D. F. Jennings, for a number of years General Manager of the Hoosac Tunnel Fast Freight Line, is now in the sales department of the Cardwell Manufacturing Co., of Chicago.

F. K. Shults, eastern sales agent of the Camel Co., Chicago, for many years, has resigned to take a position in the sales department of the American Steel Foundries, with headquarters in New York.

W. C. Webster has been appointed Manager of the New York sales office of the Westinghouse Electric & Manufacturing Co., succeeding E. W. T. Gray, who resigned recently to go into other business.

The Independent Pneumatic Tool Co., of Chicago, announces that Messrs. Lake, Hale & Co., 11 Front street, San Francisco, Cal., have been appointed the exclusive Pacific coast representatives of the company.

The More-Jones Brass & Metal Co., of St. Louis, has bought a tract 80 ft. by 236 ft., including switching facilities, adjoining its

present foundry property, on which it plans to build new buildings in the near future.

J. W. Cregar, formerly proprietor of the J. W. Cregar Agency, of Philadelphia, is now in charge of the miscellaneous department of the Niles-Bement-Pond Co., in Philadelphia, the Cregar agency having retired from business.

Charles C. Newton, President of the Newton Machine Tool Works, Philadelphia, died recently. The officers of the company are now as follows: H. W. Champion, President; William M. Graham, Treasurer, and Ellis J. Hannum, Secretary.

The Link-Belt Co. is the new name of the Link-Belt Machinery Co., of Chicago. The Link-Belt Co. owns the Link-Belt Engineering Co., of Philadelphia, and the Ewart Mfg. Co., of Indianapolis, which have been associated with the Link-Belt Machinery Co.

The Crocker-Wheeler Company, of Ampere, N. J., has opened two new offices on the Pacific coast, one an office and warehouse at 208 First street, near Howard street, San Francisco, with H. C. Baker as local manager; the other in the Pacific Electric Building, Los Angeles, with L. Cummins as local representative. The company plans soon to open an office in Seattle.

The Electro-Dynamic Co. has recently had orders from the General Pneumatic Tool Co. for 160 variable speed motors; from the National Elevator Co. for 48 motors, and from the United States Printing Co. for 21 motors. Other orders have been received from the Board of Water Supply of New York City, Farrel Foundry & Machine Co. of Ansonia, Solvay Process Co. of Syracuse, Ball & Wood Co. of Elizabeth, and Gould & Eberhardt, of Newark, N. J. Preparations are being made for enlarging the plant at Bayonne, N. J.

Iron and Steel.

The Temiskaming & Northern Ontario has decided to give contracts for 8,500 tons of rails to the Dominion Steel & Iron Co., and to the Algoma Iron & Steel Co.

The American Ship Building Co. has given orders for 1,600 tons of plates and structural shapes to the Illinois Steel Co., and will soon be in the market for some additional supplies. About 1,000 tons of steel will be needed to carry out the work of lowering the Chicago river tunnels, for which contracts have been let. The Southern has given an order for 30,000 tons of rails and has nearly completed negotiations for the purchase of an additional 30,000. The Chicago, Burlington & Quincy has given orders for 10,000 tons for 1907 delivery; the Chicago & Eastern Illinois 5,000 tons, the Evansville & Terre Haute 1,300 tons, and Swift & Co. 1,500 tons. It is said that the Carnegie works of the American Steel Co. has recently received orders amounting to 52,000 tons. The Philadelphia & Reading has bought from the Pennsylvania Steel Co. 15,000, and the New York, New Haven & Hartford 3,500 tons. The American Bridge Co. has an order for 4,100 tons of bridge material from the Cleveland Belt Railroad for the proposed structure to be built over the Cuyahoga river.

OBITUARY NOTICES.

Mrs. Theodore N. Ely, wife of the Chief of Motive Power of the Pennsylvania Railroad System, died on July 24th at her home at Bryn Mawr, Pennsylvania.

Robert William Smith, of Philadelphia, who on June 1, 1904, retired under the pension rules as Treasurer of the Pennsylvania Railroad, died on August 1st at Spring Lake, N. J. Mr. Smith was 70 years old.

John William Mackenzie, Chief Claim Agent of the Merchants Despatch Transportation Company, at New York, who for 17 years had been connected with the freight claim department of the company, died in New York City on July 30th.

Col. Alva J. Smith, General Passenger Agent of the Lake Shore & Michigan Southern, died on July 26, at Harriettstown, N. Y., near Paul Smith's in the Adirondacks. Mr. Smith was born at Churchville, N. Y., in 1840. He began railroad service in 1866 as a clerk in the general ticket office of the Cleveland, Columbus, Cincinnati & Indianapolis, now part of the Big Four. He was later made chief clerk in the same office, and, in 1874, was appointed Assistant General Passenger Agent, being made General Passenger Agent four years later. In 1881, he went to the Indianapolis & St. Louis, now also part of the Cleveland, Cincinnati, Chicago & St. Louis, as General Passenger Agent, and, later, had his authority extended also over the Cincinnati, Hamilton & Dayton, and the Dayton & Union. In 1887, he went to the Lake Shore & Michigan Southern to take the office which he held at the time of his death. Mr. Smith was Secretary of the National Association of General Passenger and Ticket Agents for a quarter of a century—1879 to 1904. He was elected Vice-President of this association in October, 1904, and President in October, 1905.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Master Car and Locomotive Painters' Association.

The thirty-seventh annual convention of this Association will be held in Washington, D. C., Sept. 11 to 14. Headquarters will be at the Hotel Arlington, the daily sessions to be held in the convention hall of the hotel. Arrangements have been made for the following hotel rates to the members of the Association and their families: American plan $3.50 per day, each person, in single rooms; all double rooms to be occupied by two persons, $7 per day; bath-rooms $2 per day additional.

The programme includes papers on the following subjects:

"The Lustre and Life of Varnish," by Charles E. Copp, J. H. Pitard, and John Hartley.

"Canvas Roofs for Passenger Equipment," by F. A. Weis, J. A. P. Glass and D. L. Paulus.

Essay: "The Well-Equipped Sand-Blast as a Factor in the Labor-Saving Economy of the Railway Car and Locomotive Paint Shop," by J. H. Whittington.

"The Painting of Freight Equipment," by J. D. Wright, John Gearheart, T. J. Hutchinson and David Murray.

"Is It to the Advantage of Railroad Corporations to Manufacture the Paints and Varnishes which they Consume?" By Joseph Maycock, Chas. F. Copp, A. T. Schroeder, and John T. McCracken.

"The Apprenticeship System in the Railway Paint Shop: Is it Receiving the Attention which it Merits?" By B. E. Miller, C. E. Cross and Fred. S. Ball.

"Brushes: Their Selection, Care and Keeping," by E. R. Clare, Thomas Cowan, A. L. Holtzman and George Durnbaugh.

There will also be discussions on the following queries:

"Is it Advisable to Cut In, Rather than to Touch Up Passenger Equipment?" Discussion opened by A. L. Allen.

"Is It Advisable to have Stationary Scaffolds in a Locomotive Paint Shop?" By D. A. Little.

"Is It Advisable to Cut or Thin Shellac with Wood Alcohol?" By W. O. Quest.

"Does Not the Superior Appearance and Extra Strength of Polished Plate Glass More than Counterbalance any Extra Cost over Double Thick Window or Crystal Sheet?" By W. E. Hibbard.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Little Falls & Dolgeville.—W. H. Newman, President of the New York Central & Hudson River, has been elected President, succeeding Dumont Clarke.

New York Central & Hudson River.—See Little Falls & Dolgeville.

Operating Officers.

Birmingham & Southern.—Charles T. Kalbaugh, formerly Trainmaster on the Pittsburg & Lake Erie, has been appointed to the new office of General Superintendent, with headquarters at Birmingham, Ala.

Chicago & North-Western.—Frank Walters, Assistant General Superintendent at Fremont, Neb., has been appointed to the new position of Assistant General Manager with headquarters at Omaha, Neb.

Chicago, Burlington & Quincy.—J. R. Phelan, General Superintendent of the Wyoming district, has resigned, to go into business on his own account. L. B. Allen, Superintendent of the lines east of the Missouri river, with headquarters at Ottumwa, Iowa, succeeds Mr. Phelan as General Superintendent, with headquarters at Alliance, Neb.

International & Great Northern.—C. Hightower, Ticket Agent at San Antonio, has been appointed Assistant Superintendent of the Gulf division, with headquarters at Palestine, Tex. Marvin H. Trice, Car Accountant, has been appointed Assistant Superintendent of the Fort Worth division, with headquarters at Mart, Tex.

Southern.—E. J. Stevens has been appointed Car Accountant of the Western district, with headquarters at Birmingham, Ala.

H. W. Beecroft, Car Accountant of the Indiana Harbor (Indiana Harbor Belt), has been appointed Car Accountant of the Middle district, with headquarters at Knoxville, Tenn.

Wabash.—John J. Sim, who was recently appointed Superintendent of the Buffalo division, was born on Oct. 5, 1858, at Cambridge City, Indiana. He attended the high school at that place and, in 1877, began railroad work as an operator on one of the lines now controlled by the Pennsylvania Company. Two years later he went to the Wabash as operator, was despatcher for 10 years from 1882 to 1892, chief despatcher from 1892 to 1893, and in December, 1893, was made trainmaster of the Detroit division, with headquarters at Montpelier, Ohio. His new appointment as Superintendent of the Buffalo division, with headquarters at Detroit, took effect August 1.

Traffic Officers.

Boston & Maine.—Dana J. Flanders, General Passenger and Ticket Agent, has been promoted to be Passenger Traffic Manager, effective September 1st. Mr. Flanders' whole railroad service has been connected with the roads which make up the Boston & Maine. He began work in early youth, became a telegraph operator, was in 1869 chief of telegraph at the Boston terminal and was in 1874 made General Ticket Agent. Since that time he has been in charge of the road's passenger department.

Mr. Flanders' successor as General Passenger Agent is Charles Morrison Burt, now General Passenger Agent of the Central Railroad of New Jersey. Mr. Burt is 44 years old. He was educated in the public schools at Meadville, Pa. In 1879, he began railroad service in the Auditor's department of the New York, Pennsylvania & Ohio, now part of the Erie. In 1883, he entered the Passenger Department of the New York, West Shore & Buffalo, and was with this road and its successor, the West Shore Railroad, until 1888. He was then made chief rate clerk of the Trunk Line Association at New York, and, in 1896, chief clerk in charge of passenger traffic of the Joint Traffic Association at New York. On August 1, 1899, he was appointed General Passenger Agent of the Fitchburg and on July 1, 1900, Assistant General Passenger and Ticket Agent of the Boston & Maine. He went to the Central Railroad of New Jersey on June 1, 1901, as General Passenger Agent, and his term of office has been characterized by a marked improvement in the passenger service of the road, which is now unexcelled among the lines leading out of New York City. Since October, 1904, Mr. Burt has been Secretary of the American Association of General Passenger and Ticket Agents.

Charles M. Burt.

Chicago & Eastern Illinois.—F. C. Reilly, Assistant General Freight Agent at Chicago, has been appointed General Freight Agent, succeeding S. J. Cooke, resigned.

Louisiana Western.—See Morgan's Louisiana & Texas.

Morgan's Louisiana & Texas.—C. S. Fay, General Freight Agent of this road and the Louisiana Western, has been appointed Traffic Manager, a position which has been vacant since the death in 1904 of W. H. Masters.

Seaboard Air Line.—A. Pope, Assistant General Freight Agent at Norfolk, Va., has resigned. His successor is Louis E. Chalenor, Assistant General Freight Agent at Savannah, Ga., whose headquarters have been transferred to Portsmouth, Va. T. P. Thompson, General Agent at Baltimore, has been appointed Assistant General Freight Agent at Savannah, to succeer Mr. Chalenor.

Engineering and Rolling Stock Officers.

Great Northern.—G. Willius, Mechanical Engineer, has resigned, to go into other business. His successor is R. D. Hawkins, General Master Mechanic of the Central district. F. M. Fryburg, Master Mechanic of the Montana Central, with headquarters at Great Falls, Mont., succeeds Mr. Hawkins, with headquarters at Minot, N. Dak.

Lake Shore & Michigan Southern.—S. K. Dickerson, who was recently appointed Superintendent of Motive Power, was born in 1859 and began railroad service in 1880 as a machinist on the Missouri, Kansas & Texas. He was for two years on the Pennsylvania and then went to the Norfolk & Western, where, in 1894, he was appointed Master Mechanic of the Radford division. In 1900, he was made Master Mechanic of the Toledo division of the Lake Shore & Michigan Southern. Later in the same year his authority was extended over the Eastern and Franklin divisions, and, in 1902, he was made Master Mechanic at Collinwood, Ohio, where he remained until his recent promotion.

Lehigh Valley.—Willard Kells, Master Mechanic at Sayre, Pa., has been transferred to Buffalo, N. Y., to succeed F. R. Cooper, resigned.

St. Louis Southwestern.—J. J. Bartholomew has been appointed Air-Brake Inspector of the St. Louis Southwestern and the St. Louis Southwestern of Texas.

Michigan Central.—LeGrand Parish, who was recently appointed Superintendent of Motive Power, was born in New York State in 1866. He began railroad work as clerk in the car department of the Lake Shore & Michigan Southern in 1891. Before that time he had worked in various machine shops and in the laboratory of Thomas A. Edison, and later with the Gilliland Electric Company. In 1896, he was made general foreman on the Lake Shore, three years later Master Car Builder of the Western division, and, in 1900, had his authority extended over the Michigan division. In 1904, he was appointed Superintendent of Motive Power of the Lake Erie & Western and of the Indiana, Illinois & Iowa.

LeGrand Parish.

Pennsylvania Lines West.—The following changes in the motive Power of the Southwest System were made on August 1st: P. F. Smith, Jr., appointed Master Mechanic of the Indianapolis division with headquarters at Columbus, Ohio, succeeding W. C. A. Henry, promoted; George B. Fravel appointed Master Mechanic of the Pittsburg division with headquarters at Dennison, Ohio, succeeding Mr. Smith; Joseph J. Walsh, Master Mechanic of the Northwest System at Chicago, appointed Master Mechanic of the Logansport division, succeeding Mr. Fravel.

Southern.—F. M. Edwards, who was recently appointed Engineer of Maintenance of Way of the Western district, was born in South Carolina in 1871 and graduated from the South Carolina Military Academy in 1890. He began railroad service the same year as draftsman for the Macon Construction Company, and later in the year he was appointed Assistant Engineer of Construction and Maintenance of the Georgia Southern & Florida. During the next six years, he was engaged in construction work for several different companies in Florida and Georgia, being part of the time Assistant City Engineer at Jacksonville. In 1896, he was appointed Resident Engineer of Construction on the Mobile, Jackson & Kansas City, and two years later went to the Southern to do similar work. He was then, for a year, Assistant Engineer on the location and construction of the Canton, Aberdeen & Nashville, now a part of the Illinois Central, and, in 1899, returned to the Southern as Assistant Engineer of Construction and Maintenance at Chattanooga, Tenn. Later he was appointed Resident Engineer at that place, which position he held until his recent promotion.

Special Officers.

Missouri Pacific.—James M. Siebert has been appointed Commissioner of Statistics, with headquarters at St. Louis.

LOCOMOTIVE BUILDING.

The Tidewater is reported in the market for 100 locomotives.

The Wabash, it is reported, is asking prices on 80 locomotives.

The Philadelphia & Reading is building 10 freight locomotives in its own shops.

The Great Northern, it is reported, will shortly receive five Mallet compound locomotives from the Baldwin Works, and is reported as in the market for 50 locomotives.

The Mexican Central, it is reported, has ordered 32 oil burning consolidation locomotives from the American Locomotive Co. for November, December and January delivery.

The Western Maryland has just ordered 24 simple consolidation locomotives from the Baldwin Locomotive Works for November, December and January delivery. These locomotives will weigh 200,000 lbs., with 182,000 lbs. on drivers; cylinders, 22 in. by 30 in.; diameter of drivers, 57 in.; straight top boiler, with a working steam pressure of 200 lbs. per sq. in.; total heating surface, 2,887 sq. ft.; 352 tubes, 14 ft. 10 in. long by 2¼ in. in diameter; firebox, 108 in. long by 70 in. wide; grate area, 52.5 sq. ft.; tank capacity, 7,000 gallons, and coal capacity, 12 tons. The special equipment will in-

clude: Walschaert valve gear, Westinghouse air-brakes, K. & M. boiler lagging, Simplex brake-beams, American Brake-Shoe & Foundry Co.'s brake-shoes, National Malleable Casting Co.'s couplers, Adams & Westlake headlights, Trojan piston and valve rod packings, consolidated safety valves, Leach sanding devices, Nathan bull's-eye lubricators, Railway Steel Spring Co.'s springs, Ashton steam gages, Latrobe driving wheel tires and cast-steel wheel centers.

The Norfolk & Southern has ordered eight 10-wheel freight locomotives, seven eight-wheel passenger locomotives, and two six-wheel switching locomotives from the Baldwin Locomotive Co. for December, 1906, delivery. The 10-wheel locomotives will weigh 138,000 lbs., with 102,000 lbs. on drivers; cylinders, 18 in. by 26 in.; diameter of drivers, 56 in.; wagon top boiler, with working steam pressure of 200 lbs.; grate area, 29.2 sq. ft.; tank capacity, 5,000 gallons. The eight-wheel locomotives will weigh 116,000 lbs., with 72,000 lbs. on drivers; cylinders, 18 in. by 24 in.; diameter of drivers, 61 in.; wagon top boiler, with a working steam pressure of 180 lbs.; total heating surface, 1,496 sq. ft.; grate area, 18.7 sq. ft.; tank capacity, 4,000 gallons. The six-wheel locomotives will weigh 100,000 lbs.; cylinders, 18 in. by 24 in.; diameter of drivers, 54 in.; working steam pressure, 180 lbs.; grate area, 17.1 sq. ft.; tank capacity, 3,000 gallons. The special equipment for all will include: Westinghouse air-brakes, Otis steel axles, Cook bell ringers, Johns-Manville boiler lagging, Pennsylvania brake-beams, Gould couplers, Dressel 18-in. headlights, Seller's injectors for the six-wheel switching locomotives and for the eight-wheel passenger locomotives, Nathan injectors for the 10-wheel freight locomotives, Ajax Metal Co. journal bearings, U. S. metallic valve rod and piston rod packing, Potts sanding devices, Nathan bull's-eye sight-feed lubricators, Pittsburg Steel Spring Co.'s springs and Gold steam heat equipment.

CAR BUILDING.

The Missouri Pacific is in the market for 100 flat cars of 80,000 lbs. capacity.

The Tidewater has ordered 50 flat cars from the American Car & Foundry Co.

The Delaware, Lackawanna & Western will build 3,500 cars at its own shops.

The Northwestern Elevated, Chicago, has ordered 34 electric cars from the Jewett Car Co.

The Mexican Central, it is reported, is in the market for upwards of 1,400 box cars.

The Denver & Rio Grande has ordered 250 ore cars from the American Car & Foundry Co.

The Northern Electric Co., Chico, Cal., has ordered four electric cars from the Niles Car Works.

The Mississippi River & Bonne Terre has ordered 200 dump cars from the American Car & Foundry Co.

The Guayaquil & Quito, it is reported, is in the market for a number of box cars of 50,000 lbs. capacity.

The Great Northern is reported to have ordered 4,000 box cars from Haskell & Barker and is figuring on 250 dump cars.

The Baltimore & Ohio, it is reported, is considering the purchase of upwards of 600 freight cars and 125 passenger coaches.

The Indiana, Columbus & Eastern Traction, it is reported, among other improvements is considering the purchase of additional rolling stock.

The Cleveland, Akron & Columbus, it is reported, at a directors' meeting authorized the purchase of 616 freight cars at a cost of about $750,000.

The Canadian Pacific has ordered five dining cars, 20 first-class coaches, 10 baggage and express cars, and 25 box cars, to be built at its Angus shops.

The Grand Trunk Pacific has, it is reported, contracted with Rhodes, Curry & Co. for 2,500 cars, delivery to commence this year and to extend over a period of five years.

The Duluth & Iron Range has asked bids on 700 steel ore cars of 100,000 lbs. capacity. It is reported that additional orders for 200 flat, box and refrigerator cars will soon be placed.

The Duluth, Missabe & Northern has asked bids for 1,500 steel ore cars of 100,000 lbs. capacity, and 60 gondola cars of 80,000 lbs. capacity. It is expected that orders will be placed this week.

The Norfolk & Southern has ordered two mail and express cars, two baggage cars, and one first-class coach for December, 1906, delivery from the Harlan & Hollingsworth Co.; 75 ventilated furniture cars of 60,000 lbs. capacity, 50 gondola cars of 60,000 lbs. capacity, and 600 ventilated box cars of 60,000 lbs. capacity from the Mt. Vernon Car & Manufacturing Co., for January, 1907, delivery, and 210 flat cars of 60,000 lbs. capacity from the American Car & Foundry Co. for November, 1906, delivery. The mail and express cars and the first-class coaches will measure 60 ft. over all and will be fitted with Monarch hollow brake-beams. The ventilated box cars will be 36 ft. over all. The special equipment will include: Westinghouse air-brakes, Monarch steel couplers, excepting the mail and express, baggage and first-class coaches will be fitted with Janney couplers; McCord dust guards, Gold heating system, McCord journal boxes, Pittsburg Steel Spring Co.'s springs, Adams & Westlake lamps, and Gold heating system for the first-class coaches; Symington journal boxes and Sterlingworth draft rigging and Winslow improved roofs for furniture cars.

The *Mobile & Ohio*, reported in the market for 200 gondola cars in our issue of July 10, has ordered 600 drop-end gondola cars of 80,000 lbs. capacity and 10 first-class passenger coaches from the American Car & Foundry Co. for fall 1906 delivery; also 10 cabooses from the Mt. Vernon Car & Mfg. Co. for fall delivery. The dimensions for the gondola cars are as follows: Weight, 34,000 lbs.; length inside, 37 ft. 1½ in.; length over all, 40 ft.; width inside, 9 ft. 8 in.; height inside, 3 ft. 9 in. The bodies and underframes are to be of wood. The special equipment includes Scullin & Gallagher body bolsters, Iron & Steel Co.'s truck bolsters, Simplex brake beams, Westinghouse brakes, Latrobe couplers, Minor draft rigging, Harrison dust guards, Eureka journal bearings, McCord journal boxes, Miner gravity side bearings, Railway Steel Spring Co.'s springs, and diamond arch bar trucks. The first-class coaches will measure 65 ft. long by 9 ft. wide; the bodies and underframes will be of wood. The special equipment will include Pullman vestibules, Ajax diaphragms, National Lock Washer Co.'s curtain fixtures, Safety Car Heating & Lighting Co.'s steam heating system, also Spear heaters, Pintsch gas for lighting, Gould hand brakes, Commonwealth Steel Co.'s double cast steel body bolsters, Tower couplers, Railway Steel Spring Co.'s springs, Westinghouse high-speed brakes, Minor gravity side bearings, Paige wheels, McCord journal boxes, Eureka journal bearings, Waycott brake beams, Streeter brake shoes, Harrison dust guards. These cars will also be equipped with American Car & Fdry. Co.'s platforms and anti-telescoping devices. The cabooses weigh 34,000 lbs. and measure 33 ft. 5½ in. long x 8 ft. 1½ in. wide inside x 6 ft. 10¼ in. high. The special equipment includes Scullin & Gallagher bolsters, Simplex brake beams, Westinghouse brakes, Chicago couplers, Minor draft rigging, Harrison dust guards, McCord journal boxes, Eureka journal bearings, Minor gravity side bearings, Railway Steel Spring Co.'s springs and diamond arch bar trucks. These cars will be partitioned to form baggage and passenger rooms. The baggage room will have large sliding doors hung on Moore's anti-friction hangers and will be equipped with coach platforms at both ends for handling passengers.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALBANY, CAIRO & GULF.—Incorporated in Georgia to build a line from Albany, Ga., via Quincy, Fla., to St. Joseph's Bay, about 175 miles. The names of the projectors are not given.

ATLANTA, BIRMINGHAM & ATLANTIC.—A contract has been given to the Callahan Construction Co. for building the Atlanta branch of this road, from Chalybeate Springs through Woodbury, Senoia and Fairburn to Atlanta, Ga.

BEAUMONT, SOUR LAKE & WESTERN.—A sub-contract has been let to King & Galvin, of Houston, for grading 12 miles of this road east from Houston, Tex. The contract calls for the completion of the work by September 15. Sunderman & Dolson also have a sub-contract and are building from Sour Lake west towards Houston. The line is being extended 65 miles from Sour Lake, the present western terminus of the road, to connect at Houston with the proposed extension of the Trinity & Brazos Valley. (See Construction Record.)

BUFFALO, LOCKPORT & ROCHESTER (ELECTRIC).—This company, incorporated in June of last year, is a consolidation of the Albion Electric Railway, the Albion & Lockport, and the Albion & Rochester Railway. Work is now under way on 54 miles of road from Rochester west to Lockport. From Lockport the company expects to use the tracks of the International Traction Company into Buffalo. A private right of way has been secured, excepting in the towns where the necessary franchises have been granted. The contracts already let call for two tracks, but the second will not be laid for some time. The company expects the line to be in operation by May of next year. The capital is $4,000,000, and it has been underwritten by the Transit Finance Co., of New York, and the Mackenzie & Mann syndicate, of Toronto.

CANADIAN PACIFIC.—Surveys are being made for a suitable route through the bog near Magog, Quebec, to do away with some long trestles. The cost of the improvement is to be about $85,000. At Cascade, B. C., the company proposes to get rid of a bridge by making a fill 1,300 ft. long and 200 ft. high. The cost of the work will be about $500,000.

A contract has been given by this company to the Toronto Construction Co. for the construction of a branch to be called the Georgian Bay and seaboard branch from Victoria Harbor, Ont., on Georgian Bay, southeast to Peterborough via Orillia, a distance of about 96 miles. Work is to be begun shortly.

CHICAGO & NORTH-WESTERN.—See South Dakota Construction.

CHICAGO, BURLINGTON & QUINCY.—This company has completed surveys for an extension of its Centralia-Herrin branch from Duquoin, Ill., to Christopher.

CHICAGO, MILWAUKEE & ST. PAUL.—Official announcement has been made that the contract for building the Butte & Whitehall division in Montana has been let to Orman & Crook at about $3,000,000. (July 27, p. 25.)

See South Dakota Construction.

CINCINNATI, COLUMBUS & TOLEDO.—An officer writes that this company, recently incorporated in Ohio to build from Cincinnati to Toledo, will at once let contracts for the work. H. H. Hoffman, Norwood, O., is President. (July 27, p. 25.)

CROSS ISLAND TRACTION.—Incorporated in New York, with $500,000 capital, to build an electric line from Brookhaven, Long Island, to West Sayville, 42 miles. William Moyer, L. Baldwin and Paul T. Brady, of New York, are directors.

DAKOTA MIDLAND.—See South Dakota Construction.

ERIE.—An officer writes respecting the proposed improvements to shorten the line from Cleveland that plans are not ready and surveys have not been made. According to reports this company is planning to lay 12 miles of second track between Galion, O., and Ashland, and eight miles from Ravenna to Leavittsburg.

GRAND TRUNK PACIFIC.—This company has filed plans of its proposed line from Edmonton, Alb., west for 77 miles, and bids are to be asked for at once for the construction of this section.

IDAHO & NORTHWESTERN.—B. R. Lewis, of Spokane, President of the Lewis Lumber Co., announces that work on the final survey for this proposed road across the Cœur d'Alene Indian Reservation will begin at once. The Department of the Interior will be applied to for permission to carry out the work. For a time it is to be used as a logging road. From Mica Bay it will be pushed into the St. Joe and St. Maries valleys, and later will be made a passenger and freight line. A length of 18 miles of the line is now in operation.

INLAND EMPIRE (ELECTRIC).—This company has completed its line from Spokane, Wash., to Waverly, 34 miles, and announces that the lines will be extended south to Lewiston, Idaho, a total of 125 miles. Jay P. Graves, of Spokane, is President. (See Spokane & Inland in Construction Record.)

KALAMAZOO, GULL LAKE & NORTHERN.—Incorporated in Michigan with $200,000 capital to build a line from Kalamazoo, Mich., to Richland and Prairieville, with a branch to Gull Lake, a total of 20 miles. The stockholders are: J. T. Upjohn, Kalamazoo; H. K. Whitney, S. O. Howes and A. A. McKay, all of Battle Creek; M. P. Huick, A. H. Brown and E. B. Hosmer, of Chicago.

LAKE ERIE & PITTSBURG.—A sub-contract has been given by the Carter Construction Co. to F. A. Maceli & Co., of Rochester, N. Y., for extending this line from Metz to Youngstown, O. (July 27, p. 25.)

LORAIN & ASHLAND.—Joseph Ramsey, Jr., is quoted as saying that this road, which has been consolidated with the Industrial Railway, is completed for a distance of 22 miles from Lorain to Wellington. Surveys are now under way to the Ohio river at or near Point Pleasant, and for two branches to run to coal fields in southern and southwestern Ohio. It is the intention of the company to seek connection with the tidewater at or near Point Pleasant. The Industrial Railroad, now merged with the Lorain & Ohio, is a belt line about 10 miles long at Lorain, with a spur to Oak Point. The maximum grades on the new line will be 26 ft. to the mile.

MEXICAN INTERNATIONAL.—This company, it is said, will build a branch from Allende to Las Vegas opposite Del Rio, Tex. The distance is about 60 miles.

MINNEAPOLIS & ST. LOUIS.—See South Dakota Construction.

MISSISSIPPI CENTRAL.—An officer writes that work is now under way by the Worthington Construction Co., of Brookhaven, Miss., and the O. A. Gibson Construction Co., of Natchez, Miss., extending the line from the present western terminus at Brookhaven, Miss., to Natchez, 66 miles. There are to be four steel girder bridges. (July 20, p. 19.)

MISSOURI RIVER & GULF.—Chartered on August 1st at Topeka, Kan., to build from Kansas City, Kan., south to Denison, Tex., the northern terminus of the Houston & Texas Central, with branches from Lehigh, Ind. T., southeast to Shreveport, La., and from a point in Cherokee County, Kan., east to Joplin, Mo.

NORTH COAST.—Robert E. Strahorn, President of this company, announces that he has practically secured the right of way for the line from a point 69 miles west of Spokane, across the state of Washington, to a point 75 miles east of Tacoma, and he expects to begin work early next year. The line will cross the Yakima Indian Reservation and forest reserve. Local reports say that it is backed by the Chicago & North-Western.

OREGON RAILWAY & NAVIGATION COMPANY.—J. P. O'Brien, Vice-President and General Manager of this company, recently announced that the line from Riparia, Wash., east to Lewiston, Idaho, 72 miles, was to be put in operation at once. (See Construction Record.)

PEEKSKILL LIGHTING & RAILROAD COMPANY.—See Putnam & Westchester Traction.

PENNSYLVANIA.—The last spike was driven July 27 at Quarryville, completing the low-grade line of this company which has been building for the past three years from Yorkhaven, Pa., on the Northern Central, east to Atglen, on the main line, 47 miles west of Philadelphia. (July 13, p. 12.)

A contract has been given to the John A. Kelley Co. for grading, masonry and track-laying on the whole of the proposed cut-off on the West Jersey & Seashore, from a point on the Cape May division, north of Westville, east to a connection with the Delaware river bridge line near West Haddonfield Junction. By this cut-off, which is to be five miles long, freight from the West Jersey & Seashore main line, and its branches in southern New Jersey, can be sent to the Amboy division at Delair without taking it through Camden. The contract also includes changing the Delaware river bridge tracks in West Haddonfield.

This road is reported planning to establish new yards at Buffalo. The plan includes a line to connect the Pittsburg line with the Western New York & Pennsylvania line, both of which are parts of the Pennsylvania. The cost is estimated at $500,000.

PHILIPPINE RAILWAY CO.—At a recent meeting of this company at 43 Exchange Place, New York, the following officers and directors were elected: William Salomon, Chairman; Charles M. Swift, President; H. M. Steele, Vice-President; C. Lewis, Treasurer; G. H. Ashmead, Secretary. The directors are William Salomon, Charles M. Swift, Cornelius Vanderbilt, Alonzo Potter, C. Lewis, Thomas H. Hubbard, J. G. White, Frederick H. Reed and Henry R. Wilson.

POINT JUDITH.—A corporation has been organized at Narragansett Pier, with $100,000 capital, to build a line from Narragansett Pier, R. I., to Point Judith, and to operate it in connection with a line of steamers running between Point Judith and the eastern end of Long Island to connect with the Long Island Railroad. Jeremiah Robinson, of New York, and Wakefield, R. I., was elected President; Frank P. Sturges, of New York, Vice-President, and Isaac R. Robinson, of New York, Secretary and Treasurer.

PUTNAM & WESTCHESTER TRACTION.—An officer writes that contracts will be let and work started in September of this year on this proposed electric road. The route is from Main street, Peekskill, N. Y., northeast to Oregon, Putnam County, 3.75 miles. The road does not cross the county line, but is to be wholly in Westchester County. It is to be operated by the Peekskill Lighting & Railroad Co. J. S. Ladd is President and I. W. Reynolds, Chief Engineer, Peekskill, N. Y. (July 20, p. 19.)

ST. LOUIS, HILLSBORO & SOUTHERN (ELECTRIC).—According to H. M. Bowen, of Alton, Ill., President and General Manager of this Missouri company, which was organized in 1902, work is to be started at once and the road completed in about ten months. A contract was let early in July to an eastern contractor and grading is to be begun shortly. The right of way has been secured except for a short distance in Jefferson County. The proposed route is from St. Louis, Wis., south through the towns of Bobring, Sappington, Fenton, Highridge, Byrnesville and Cedar Hill to Hillsboro, Mo. R. E. Williams is President; H. D. Brandt, Secretary, St. Louis, and J. H. Winer, Hillsboro, Treasurer.

SAN ANTONIO & GULF.—See Southern Pacific.

SCHENECTADY & MARGARETVILLE.—Incorporated in New York, with $1,000,000 capital, to build a line from Schenectady, N. Y., southwest to Margaretville, Delaware County, which is on the Ulster & Delaware, with branches from Schenectady to Scotia, and to Rotterdam Junction, connecting with the New York Central and the Boston & Maine. The directors are: Frank J. Whan, A. H. Whan, George M. Turner, Edward J. Welch, George E. Relyes, M. Caswell Heine, Albert S. Brown, George S. Fulton, of New York City, and James H. Richards, of Cranford, N. J.

SOUTHERN PACIFIC.—It is unofficially stated at the headquarters of the Sonora Railway that the main line which the Southern Pacific is to build into western Mexico will run from Benson, Ariz., to Nacozari, thence down the valley of the Yaqui river via Alamos and Culican to the port of Mazatlan, and to Guadalajara, where it will connect with the Mexican Central. It is stated that the Cananea, Yaqui River & Pacific will form the connecting link in this main line.

According to Captain J. M. Lee, Superintendent of Construction on the extension of the Stockdale branch from Stockdale, Tex., east

to Cuero, 40 miles, the line is completed and is to be opened at once. This new line has been built under the name of the San Antonio & Gulf. The line connects at Cuero with a direct line to the gulf at Port Lavaca. (See Construction Record.)

South Dakota Construction.—The building of new railroads is being pushed in a number of different parts of the state. On the eastern end of the Chicago & North-Western's extension, from the Missouri river at Pierre to Rapid City in the Black Hills, 10 miles of track are already laid and a track-laying machine has just been put at work. The company now expects to have the line in operation as far as Midland, 60 miles west of the river, by the first of September. A pile bridge across the Missouri is again being put in, the former one having been out ever since the ice went out last spring. The new bridge is to be used until spring, when it will probably be similarly carried out by the ice. A great deal of material for the permanent bridge is being assembled and preliminary work is being done, but active work on the new bridge has not yet been begun. From the western end of the extension, about 20 miles of track is laid east from Rapid City, and work is being pushed eastward as rapidly as possible. The construction crews at both ends of the line are short of men, although on the western end the shortage is made up to some extent by employing Indians on the rougher work.

The Chicago, Milwaukee & St. Paul is also building an extension from the Missouri river to Rapid City, under the corporate name of the White River Valley Railway. This is now completed from Chamberlain, the previous terminus of a St. Paul line, to Murdo, about 60 miles west, and grading crews are at work all along the line to Rapid City. There is some rough country through the Bad Lands to be dealt with, and it is hardly possible that the line will be put through to Rapid City before next spring or summer. The new Pacific Coast line of the St. Paul strikes west from the Missouri river in the northern part of South Dakota. The line now terminates at Evarts, turning south a few miles to reach this point. A new location about 12 miles further up the river has been selected as the crossing of the new trans-continental line, and a branch has been built from Glenham, the first town on the railroad back from the river, to the new crossing site at Flora. The track from Glenham to Evarts is to be abandoned. Preliminary work is being done west of the river, and some of the grading is already under way.

The Minnesota, Dakota & Pacific, the extension of the Minneapolis & St. Louis from Watertown west to the Missouri river, 150 miles, with a 100-mile branch, although not announced until late in the spring, is doing fast construction work and is likely to have trains running to the river late this fall.

The Dakota Midland is a new line lately incorporated whose backing is not yet known. It is locally credited to each the North-Western, the Minneapolis & St. Louis, and the Illinois Central. This company has a surveying crew followed by right-of-way men at work northwest from Sioux City to Pierre. A reason for believing that this is a North-Western project is the fact that the Dakota Midland route would give the North-Western a shorter line from South Dakota into Sioux City and Omaha than at present. With the completion of the Rapid City extension, the Black Hills traffic of the North-Western instead of turning to the southward before coming east will be able to come directly east through Pierre, and this would be a reason for improving the connections from Pierre eastward. The projected route of the new road lies through territory already well occupied by the St. Paul.

Spokane-Pend d'Oreille Rapid Transit Company.—R. A. Hutchinson, General Manager of this company, which is building an electric line from Spokane northeast to Lake Pend d'Oreille, Idaho, has filed deeds showing the right of way at Rathdrum, Idaho, and announces that work will begin early in August. The cost of the line, which is to be 34 miles long, will be about $3,000,000. (May 11, p. 144.)

Texas, New Mexico & Pacific.—Local reports state that work has been started on this new line, which is to run from McKinney, Tex., to Roswell, N. Mex., about 450 miles. (March 30, p. 99.)

West Jersey & Seashore.—See Pennsylvania.

Youngstown & Ohio River.—A contract has been let to the P. G. Guthrie Construction Co., of Columbus, for building six miles of this line from East Liverpool to Lisbon. Work is to be started at once.

RAILROAD CORPORATION NEWS.

Berkeley Railroad.—The Berkeley Railroad, a standard gage road running from Chicora, S. C., to Monck's Corners, on the Atlantic Coast Line was sold at foreclosure sale on July 23rd for $10,000 to the E. P. Burton Lumber Co., of Charleston, S. C.

Canadian Northern.—The Canadian Northern has bought the Qu'Appelle, Long Lake & Saskatchewan, until recently the Prince Albert branch of the Canadian Pacific, which runs from Regina, Assin., north to Prince Albert, 249 miles. The purchase price is reported to be $500,000 cash, besides taking over the bonded debt, which consists of $3,809,840 first mortgage bonds of 1911. These are 6 per cent. bonds, but have been receiving a lower rate of interest, the balance being paid in certificates to be redeemable out of surplus earnings. The Canadian Pacific, which has for a number of years operated the road, is said to have allowed an option to buy it for $195,000 to expire.

See Canadian Northern Ontario.

Canadian Northern Ontario Railway.—This road, formerly called the James Bay Railway, which is being built by Canadian Northern interests from Toronto, Ont., north to Sudbury, 268 miles, is to issue 3½ per cent. debenture stock at the rate of $20,000 a mile, or $5,360,000. This stock is to be payable in 1936, and is guaranteed principal and interest by the government of the province of Ontario. The line is reported as practically finished from Toronto to Parry Sound, about 150 miles, with most of the grading and bridge work completed for the rest of the distance.

Canadian Pacific.—Earnings for the past fiscal year ended June 30, 1906, show surprising increases. Gross earnings were $61,669,758 against $50,481,882 in 1905, and about $46,500,000 in 1904, an increase for 1906 over 1905 of 22 per cent. Net earnings for 1906 show even more remarkable gains, being $22,973,313, against $15,475,088 in 1905 and some $14,200,000 in 1904, an increase over last year of nearly 50 per cent.

Chesapeake & Ohio.—For the year ended June 30, 1906, the Chesapeake & Ohio earned $24,602,989 gross, against $20,724,371 in the previous year. Net earnings increased from $7,473,405, in 1905, to $9,733,340. The operating ratio was 60.4 per cent. against 63.9 per cent. in 1905.

Colorado & Southern.—This road, with the same operated mileage as in the previous year, earned in the fiscal year closed June 30, 1906, according to the preliminary statement just issued, $11,879,953, an increase of $2,222,373, or about 23 per cent. over 1905. Net earnings were $3,489,325, an increase of $1,220,668 over 1905.

Fort Smith & Western.—This railroad company, which operates a line from Fort Smith, Ark., to Guthrie, Okla., 217 miles, has bought the St. Louis, El Reno & Western, which runs from Guthrie southwest to El Reno, 42 miles. The purchase price is reported to have been $1,000,000. It is planned to make an extension of the newly acquired line from El Reno southwest to a point on the Kansas City, Mexico & Orient.

Great Northern.—According to a despatch from St. Paul dated July 31st, during a hearing on merchandise rates in Minnesota, before the state Railroad and Warehouse Commission, R. I. Farrington, Second Vice-President of the Great Northern, made the statement that, no matter how great the earnings of the company, President James J. Hill had laid down the rule that stockholders should never receive a higher dividend than 7 per cent. Mr. Farrington also said that improvements were paid for out of surplus until a new issue of stock became necessary, when stock was issued $25,000,000 at a time. It was also shown that the Great Northern now has on hand a surplus of over $19,000,000.

Little Falls & Dolgeville.—See New York Central & Hudson River.

New York Central & Hudson River.—Official announcement was made on July 27, at Utica, that the New York Central had secured a controlling interest in the Little Falls & Dolgeville Railroad. New officers have been elected representing the New York Central interests. The Little Falls & Dolgeville is a 10-mile road connecting Dolgeville, a manufacturing town, with the main line of the New York Central at Little Falls. On June 30, 1904, it had $250,000 stock and $250,000 3 per cent. bonds maturing in 1932, outstanding. Gross earnings for the year ended on that date were $42,306; net earnings, $10,914.

Northern Pacific.—From the report of estimated gross earnings recently issued by the road, it appears that the Northern Pacific will be one of the leaders in the increase column of the records for the last fiscal year. The gross earnings of the system for the year ended June 30, 1906, are estimated at $62,140,410, against $51,729,362 in 1905. This is an increase of over $10,400,000, more than 20 per cent. The total length of road has in the same period increased 149 miles, from 5,632 to 5,781 miles.

St. Louis, El Reno & Western.—See Fort Smith & Western.

Southern Railway.—The year's gross earnings for the period ending June 30, 1906 were $53,641,439, against $48,145,108 in 1905, an increase of nearly $5,500,000. Operating expenses at the same time increased $4,690,000, leaving gross earnings of $13,868,300, an increase of $805,706 over 1905. The operating ratio increased from 72.87 per cent. in 1905 to 74.15 in 1906. These figures are exclusive of the Mobile & Ohio, Cincinnati, New Orleans & Texas Pacific, Alabama Great Southern and Georgia Southern & Florida.